Arlington Basin Groundwater Management Plan

December 2011

WESTERN MUNICIPAL WATER DISTRICT

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1969 Western Judgment	Judgment in *Western Municipal Water District of Riverside County et al., vs. East San Bernardino County Water District* et al.
AB	Assembly Bill
AF	acre-feet
AFY	acre-feet per year
ASR	aquifer storage and recovery
AWQ	Ambient Water Quality Database
Basin Plan	Water Quality Control Plan for the Santa Ana Basin
BMO	Basin Management Objective
CASGEM	California Statewide Groundwater Elevation Monitoring
Corona	City of Corona
DEH	Riverside County Community Health Agency's Department of Environmental Health
DPH	California Department of Public Health
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
EC	Existing Conditions
EPA	United States Environmental Protection Agency
GPS	global positioning satellite
GV	Groundwater Vistas, Version 5
GWMP	groundwater management plan
Home Gardens	Home Gardens County Water District
InSAR	Interferometric Synthetic Aperture Radar
IRP	integrated resources plan
IRWMP	integrated regional water management plan
JPA	Joint Powers Agreement
LAFCO	Local Agency Formation Commission

MCL	maximum contaminant level
mgd	million gallons per day
mg/ L	milligrams per liter
MOU	Memorandum of Understanding
msl	mean sea level
Metropolitan	Metropolitan Water District of Southern California
N	nitrogen
NPDES	National Pollutant Discharge Elimination System
OCWD	Orange County Water District
OWOW	One Water One Watershed – Santa Ana Watershed Integrated Regional Water Management Plan
Plan Area	area covered by the Arlington Basin Groundwater Management Plan
ppm	parts per million
RAGFM	Riverside-Arlington Groundwater Flow Model
RCFCWCD	Riverside County Flood Control and Water Conservation District
RO	reverse osmosis
RPU	Riverside Public Utilities
RWQCB	Santa Ana Regional Water Quality Control Board
RWQTP	Regional Water Quality Treatment Plant
SABRINA	Santa Ana Basin Relational Information Network Application Database
Santa Ana River Judgment	Judgment in *Orange County Water District vs. City of Chino et al.*
SARI	Santa Ana Regional Interceptor
SAWDMS	Santa Ana Watershed Data Management System
SAWPA	Santa Ana Watershed Project Authority
SB	Senate Bill
SMCL	secondary maximum contaminant level
SVOCs	semi-volatile organic compounds
SWP	State Water Project
SWRCB	California State Water Resources Control Board

TDS	total dissolved solids
USGS	United States Geological Survey
Valley District	San Bernardino Valley Municipal Water District
Western	Western Municipal Water District
WRCRWA	Western Riverside County Regional Wastewater Authority
WRCRWTP	Western Riverside County Regional Wastewater Treatment Plant

1 INTRODUCTION AND BACKGROUND

1.1 PURPOSE OF THE GROUNDWATER MANAGEMENT PLAN

The goal of this Groundwater Management Plan (GWMP) is to provide a planning framework to operate and manage the groundwater basin in a sustainable manner to ensure a long-term reliable supply for beneficial uses among all stakeholders in the basin.

The purpose of this GWMP, including development of the plan and the plan document itself, is to inform the public of the importance of groundwater to the Arlington Basin and the challenges and opportunities it presents; develop consensus among stakeholders on issues and solutions related to groundwater; build relationships among stakeholders within the Arlington Basin and with local, state, and federal agencies; and define actions for developing project and management programs to ensure the long-term sustainability of groundwater resources in the Arlington Basin. This GWMP provides action items that, when implemented, are designed to optimize groundwater levels, enhance water quality, and minimize land subsidence.

1.2 DESCRIPTION OF THE GROUNDWATER BASIN AND PLAN AREA

The Arlington Basin GWMP area (Plan Area) is the portion of the Riverside-Arlington Groundwater Subbasin (Subbasin Number 8.2-03), as defined by the California Department of Water Resources' (DWR) Bulletin 118-03 (DWR, 2003), that is outside the boundaries of the Riverside Basin (both North and South), as defined by *Western Municipal Water District of Riverside County v. East San Bernardino County Water District*, County of Riverside Superior Court No. 78426 (1969) (1969 Western Judgment). The Plan Area is shown on Figure 1.1. The Plan Area boundaries as defined by Bulletin 118-03 are used to identify the alluvial aquifer system and to be consistent with statewide planning efforts. The Plan Area boundary between the Arlington Basin and the Riverside Basin is defined by the 1969 Western Judgment and is used to maintain consistency with existing management structures defined in that document and in later planning efforts. Areas within the northern portion of the DWR-defined Riverside-Arlington Basin and inside the 1969 Western Judgment-defined Riverside Basin are included in the Riverside Basin GWMP (WRIME, 2011a. Overlying municipalities are shown on Figure 1.2 and include Riverside and a small portion of Corona. The Plan Area is entirely within Riverside County. Water agencies serving areas overlying the Plan Area are shown on Figure 1.3 and include the City of Corona (Corona), Riverside Public Utilities (RPU), and Western Municipal Water District (Western). Home Gardens County Water District (Home Gardens) is just beyond the southwestern boundary of the Arlington Basin in the adjacent Temescal Basin.

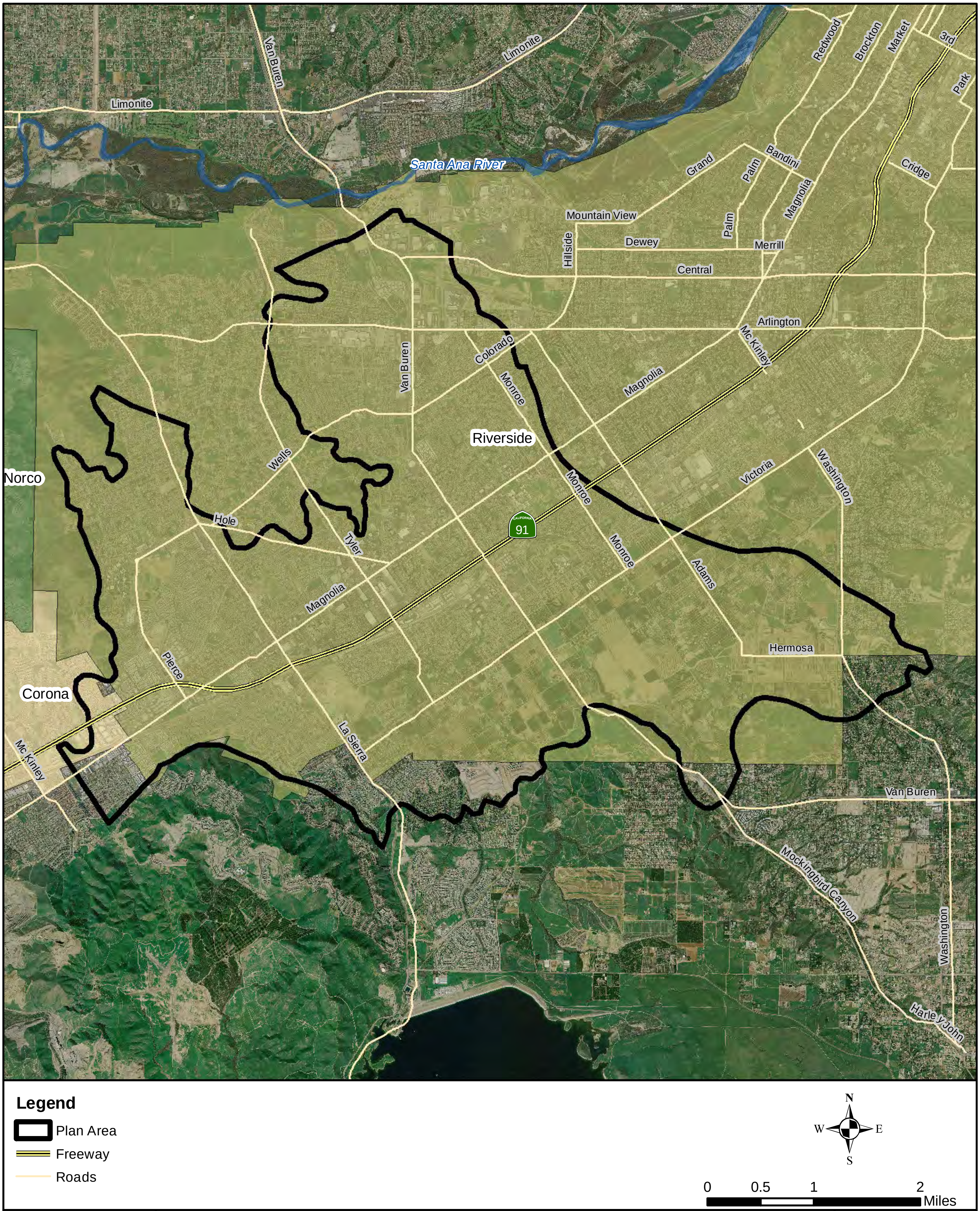
WESTERN MUNICIPAL WATER DISTRICT

Plan Area

Arlington Basin Groundwater Management Plan

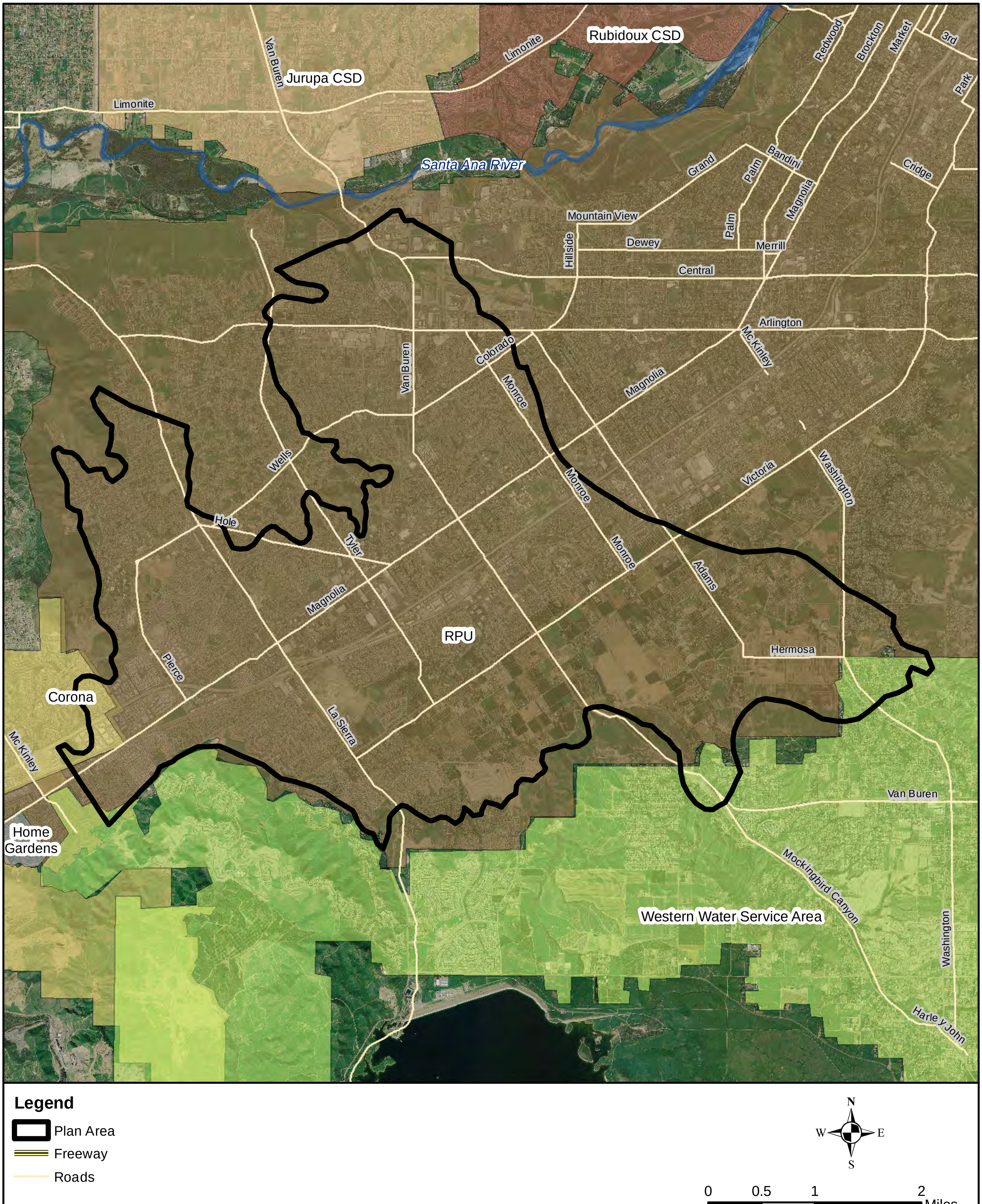
2010

Figure 1.1



WESTERN MUNICIPAL WATER DISTRICT

Municipalities Arlington Basin Groundwater Management Plan	2009 Figure 1.2



WESTERN MUNICIPAL WATER DISTRICT

Water Agencies

Arlington Basin Groundwater Management Plan

2009

Figure 1.3

1.3 GROUNDWATER MODEL

A groundwater model was developed to assist in the development of this GWMP and to guide future groundwater planning efforts. The Riverside-Arlington Groundwater Flow Model (RAGFM) is a saturated groundwater flow model constructed using the U.S. Geological Survey (USGS) groundwater flow code MODFLOW-2000 (Harbaugh, 2000) and the pre- and post-processor program Groundwater Vistas (GV) Version 5 (Rumbaugh and Rumbaugh, 2007). The groundwater model is a tool for improving the understanding of the groundwater basin and the potential benefits and impacts of proposed water supply planning scenarios.

The Riverside-Arlington Groundwater Flow Model area covers 95.5 square miles (mi^2), consisting of 23.2 mi^2 in the Arlington Basin, 65.3 mi^2 in the Riverside Basin, and 7 mi^2 in the Rialto-Colton Basin. This area is modeled with up to three layers (one layer in the Arlington Basin) with 182,700 cells per layer, representing, from top to bottom:

1) Coarser alluvium and river deposits along the Santa Ana River
2) Shallower alluvium with higher conductivities
3) Deeper alluvium with lower conductivities

The model simulates hydrology for the 1965 to 2007 time period, which includes normal, wet, dry, and extended drought conditions. For comparison to proposed water supply planning scenarios, an Existing Conditions baseline scenario was developed, representing 2007 conditions, plus 8,200 AFY of groundwater production by Flume Wells in the Riverside Basin.

Based on the overarching goal of operating the groundwater basin in a sustainable manner for reliable supply for beneficial uses, this GWMP develops basin management objectives (BMOs) (See Section 5) and elements (See Section 6) that provide targets and actions to meet that goal. The groundwater model is used to investigate the future impact of current and projected operations relative to the goal and BMOs and to investigate the ability of hypothetical mixes of potential projects to move the basin closer to meeting the goal and BMOs. A description of this effort is provided in Section 7.1.2. Additional details on the RAGFM are described in *Riverside-Arlington Groundwater Flow Model (RAGFM) Model Development and Scenarios* (WRIME, 2011a).

1.4 OVERVIEW OF WATER REQUIREMENTS AND SUPPLIES

The Plan Area covers 14,730 acres (approximately 23 mi^2) and is extensively developed. Land use is approximately 68% urban, 13% undeveloped or vacant, 2% irrigated parks, and 17% irrigated agriculture (Southern California Association of Governments, 2005), as shown on Figures 1.4a and 1.4b. Urban areas include a portion of the City of Riverside, a very small portion of Corona, and urbanized unincorporated areas within Riverside County. Agricultural use is predominantly citrus groves and wholesale nurseries.

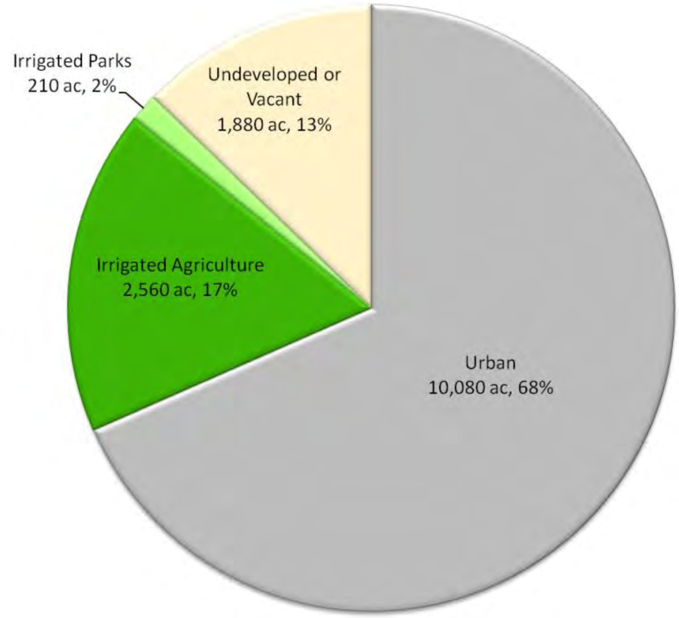
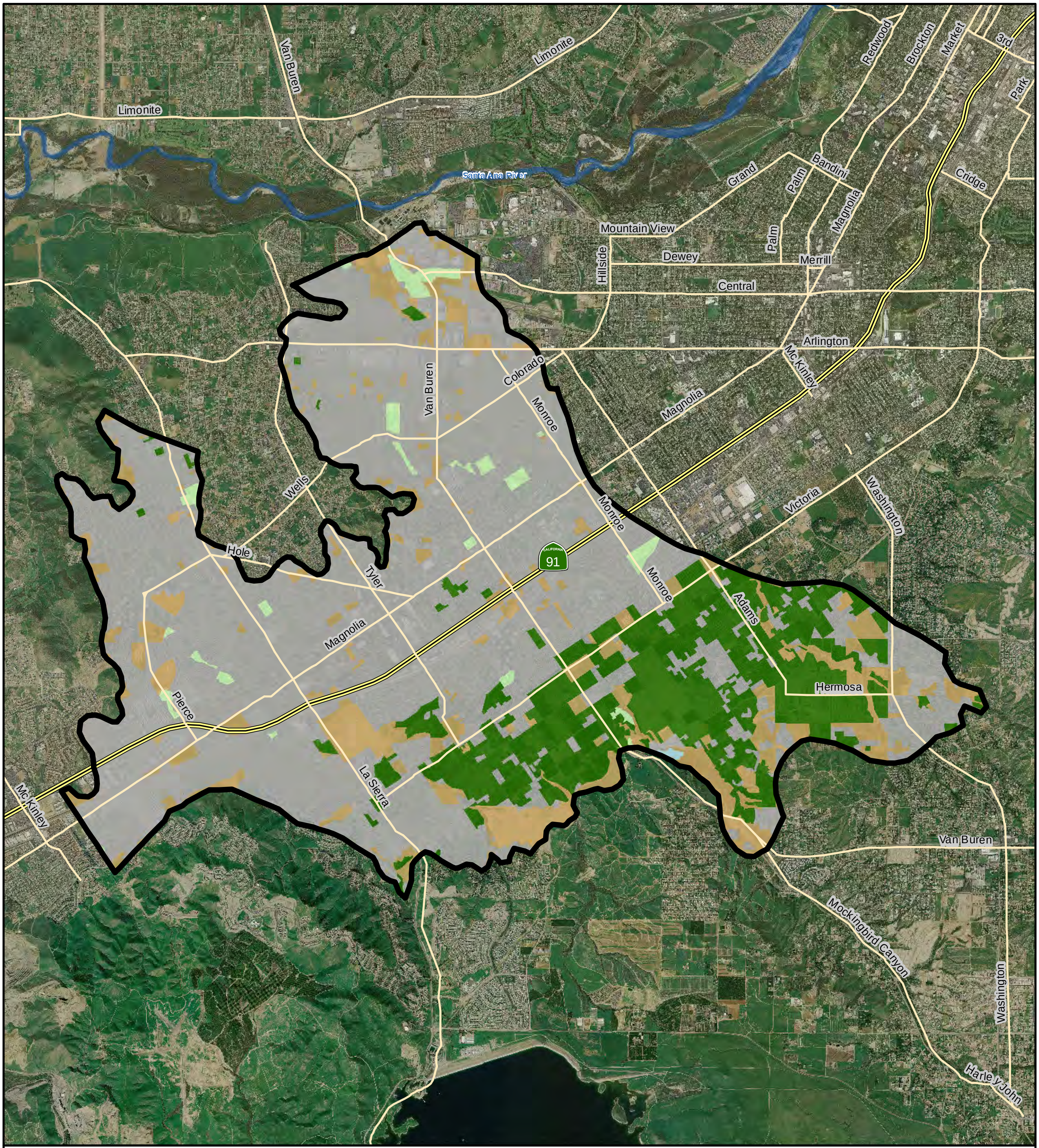


Figure 1.4a Land Use Summary, 2005

While Plan Area groundwater provides only a small portion of the water supplies for these uses, it is a local, reliable water source that is important for the future prosperity and sustainability of the region. Approximately 8,600 acre-feet (AF) of groundwater was produced from the Plan Area in 2009, with 19% coming from private wells for use within the basin and the remaining 81% coming from Western's Arlington Desalter wells (San Bernardino Valley Municipal Water District (Valley District) and Western, 2010). Figure 1.5 shows groundwater production by producer for 2009. Other water supply sources, including all supplies for municipal use, include groundwater from nearby groundwater basins, such as Rialto-Colton, Riverside, and Bunker Hill; imported water; and recycled water.



Legend

Plan Area
Freeway
Roads

Land Use *

Urban
Parks
Agriculture
Vacant
Water

*Land use source: SCAG, 2005

0 0.5 1 2 Miles

WESTERN MUNICIPAL WATER DISTRICT

Land Use, 2005

Arlington Basin Groundwater Management Plan

2010

Figure 1.4b

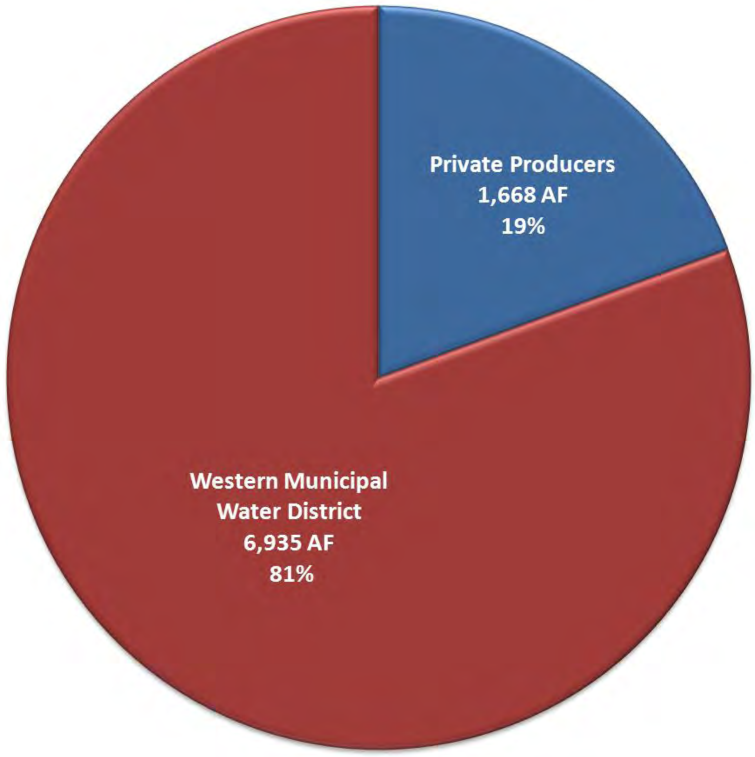


Figure 1.5 Groundwater Production by Agency, 2009

The Plan Area and the surrounding region are experiencing growth, and water demands are anticipated to increase as a result. While the majority of the Plan Area is developed for urban or agricultural use, projected growth will occur through infill throughout the basin. As competition for imported water supplies continues to become more intense and as drought, regulatory changes, and potential catastrophic failures threaten imported supplies, groundwater will continue to play a key role in creating a cost-effective and reliable water supply in the Plan Area through private production and operation of desalters for potable municipal use.

1.5 LEGISLATION RELATED TO GROUNDWATER MANAGEMENT PLANS

Groundwater is a resource shared by numerous users. It does not recognize or adhere to jurisdictional lines and cannot be tagged for use by certain users. Groundwater rights have evolved through case law since the late 1800s. Currently, there are three basic methods for managing groundwater resources in California:

- Local agency management under authority granted by the California Water Code or other applicable state statutes (such as a GWMP)
- Local government groundwater ordinances or joint powers agreements (JPA)

- Court adjudications

No law requires that any of these be applied within the Plan Area. As such, management is often instituted after local agencies or landowners recognize a specific groundwater problem. The level of groundwater management in any basin or subbasin is often dependent on water availability and demand.

In an effort to standardize groundwater management, the California Legislature passed Assembly Bill (AB) 255 (Stats. 1991, Ch. 903) in 1991. This legislation authorized local agencies overlying basins subject to critical overdraft conditions, as defined in DWR's Bulletin 118-80 (DWR, 1980), to establish programs for groundwater management within their service areas. Water Code § 10750 et seq. provided these agencies with the powers of a water replenishment district to raise revenue for facilities to manage the basin for the purposes of extraction, recharge, conveyance, and water quality management. Seven local agencies adopted plans under this authority (DWR, 2003).

The provisions of AB 255 were repealed in 1992 with the passage of AB 3030 (Stats. 1992, Ch. 947). This legislation greatly increased the number of local agencies authorized to develop a GWMP and set forth a common framework for management by local agencies throughout California. AB 3030, codified in Water Code § 10750 et seq., provides a local agency (those overlying the groundwater basins defined by DWR's Bulletin 118 (DWR, 1975) and updates (DWR, 1980, 2003)) a systematic procedure to develop a GWMP. Upon adoption of a plan, these agencies could possess the same authority as a water replenishment district to "fix and collect fees and assessments for groundwater management" (Water Code, § 10754). However, the authority to fix and collect these fees and assessments is contingent on receiving a majority of votes in favor of the proposal in a local election (Water Code, § 10754.3). More than 200 agencies (shown on Figure 1.6) have adopted an AB 3030 GWMP. None of these agencies is known to have exercised the authority of a water replenishment district.

Figure 1.6.
Areas with Groundwater Management Plans

Water Code section 10755.2 expands groundwater management opportunities by encouraging coordinated plans and by authorizing public agencies to enter into a JPA or memorandum of understanding (MOU) with public or private entities providing water service. At least 20 coordinated plans have been prepared to date involving nearly 120 agencies, including cities and private water companies.

In 2002, the California Legislature passed Senate Bill (SB) 1938 (Stats. 2002, ch. 603), which provides local agencies with incentives for improved groundwater management. While not providing a new vehicle for groundwater management, SB 1938 modified the Water Code by requiring that specific elements be included in a GWMP in order for an agency to be eligible for particular DWR funds for groundwater projects.

Through AB 3030 and SB 1938, local agencies can now develop GWMPs, such as this one, that guide the sustainable usage of the groundwater resource while also providing access to particular DWR funding sources.

1.6 PRIOR AND CURRENT WATER MANAGEMENT PLANNING EFFORTS

Several existing documents, including regulatory guidelines and planning recommendations, currently are used to manage groundwater in and around the Plan Area. This GWMP expands on these documents and in no way affects any previous court adjudications.

1.6.1 1969 WESTERN JUDGMENT

The Arlington Basin is not covered by the 1969 Western Judgment, but information is provided here due to its regional importance. The 1969 Western Judgment established the entitlements and groundwater replenishment obligations of the two major water agencies, Valley District and Western, relating to groundwater basins in their jurisdictions: the San Bernardino, Riverside, and Colton Groundwater Areas (these areas are defined by DWR as the Bunker Hill Groundwater Basin, Rialto-Colton Groundwater Basin, and the northern portion of the Riverside-Arlington Groundwater Basin). The Riverside Basin is split by the 1969 Western Judgment based on county boundaries into Riverside North (San Bernardino County) and Riverside South (Riverside County). The discussion in this subsection is based on the Western Integrated Regional Water Management Plan (IRWMP) (Western, 2008b).

The case was brought forth following concerns over the increasing groundwater withdrawals upgradient of the Bunker Hill Dike (San Jacinto Fault) for use within San Bernardino and Redlands as well as for export to Riverside County. It was initially linked to a broader case involving the Chino and San Bernardino Basins, as well as the diversions of surface water and pumping of underflow from the Santa Ana River and its tributaries.

The adjudication resulted in the naming of a Watermaster, consisting of two persons, one nominated by Valley District and the other by Western. The Watermaster prepares an annual report documenting the previous water year's pumping and export activities. In addition, groundwater elevation measurements, stream flow, and water quality measurements are documented.

The 1969 Western Judgment also requires the Watermaster to establish extraction rights and export rights based on the average annual extractions and exports that occurred over the 5-year period from 1959 through 1963.

The Watermaster uses the results of the documented information to make the following determinations as required by the 1969 Western Judgment.

1. Total actual average annual extractions from the San Bernardino Basin area by entities other than plaintiffs for use within San Bernardino County.
2. The natural safe yield of the San Bernardino Basin area based upon the cultural conditions equivalent to those existing during the 5-calendar-year period ending with 1963, determined initially by supplemental order of the Court to be 232,100 AF per annum, the amount is subject to the continuing jurisdiction of the Court.
3. The annual "adjusted right" of each exporter (plaintiff) to extract water from the San Bernardino Basin area based upon the percentage of the natural safe yield determined by the methods used in Table B-2 of the 1969 Western Judgment.
4. The annual production by plaintiffs for comparison with adjusted right determined in Item 3.
5. Annual discharge from the City of San Bernardino Water Quality Control Plant to the Santa Ana River as to quantity and quality, assumed for the purposes of the 1969 Western Judgment to be 16,000 AF annually and not subject to verification by the 1969 Western Judgment.
6. Average annual extractions from the Colton Basin area for use outside the San Bernardino Valley.
7. Average annual extractions from the Riverside Basin area within San Bernardino County for use outside the San Bernardino Valley.
8. The average static water levels within the Colton Basin and Riverside Basin within San Bernardino County as determined by the three wells listed in the 1969 Western Judgment (1S 4W 21 Q3, 1S 4W 29 H1, and 1S 4W 29 Q1); the elevation has been established at 822.04 feet above sea level, based on fall 1963 measurements.
9. The average annual extractions from that portion of the Riverside Basin area in Riverside County which is tributary to the Riverside Narrows for use in Riverside County.
10. Annual amounts of water extracted for use within Western from the San Bernardino Basin and the area downstream from there to the Riverside Narrows that have been exported for use outside the area tributary to the Riverside Narrows.
11. Annual amount of water extracted for use within San Bernardino County from the San Bernardino Basin area and Colton Basin area for use on lands that are not tributary to the Riverside Narrows.
12. Reduction in return flow now contributing to base flows at Riverside Narrows that results from conversion of agriculture using water within Western to domestic or other

uses connected to a sewage or waste disposal system, the effluent from which is not tributary to the rising water at Riverside Narrows; the average for 5 years ending in 1963 was established by the 1969 Western Judgment to be 3,916 acres and is not subject to verification.

1.6.2 SANTA ANA RIVER JUDGMENT

Orange County Water District (OCWD) filed a complaint on October 18, 1963, seeking an adjudication of water rights against substantially all water users in the area tributary to Prado Dam within the Santa Ana River Watershed, excluding the San Jacinto Watershed, which is tributary to Lake Elsinore. Thirteen cross-complaints were filed in 1968, extending the adjudication to include substantially all water users in the area downstream from Prado Dam. With some 4,000 parties involved in the case (2,500 from the Upper Area and 1,500 from the Lower Area), many believed that every effort should be made to arrive at a settlement and physical solution to avoid enormous and unwieldy litigation. The discussion in this subsection is based on the Western IRWMP (Western, 2008b).

The stipulated judgment (Santa Ana River Judgment) in *Orange County Water District vs. City of Chino et al.*, entered on April 17, 1969 (County of Orange Case No. 117628) became effective on October 1, 1970. It contains a declaration of rights of water users and other entities in the Lower Area of the Santa Ana River Basin downstream of Prado Dam as against those in the Upper Area tributary to Prado Dam, and it provides a physical solution to satisfy those rights.

The physical solution accomplishes, in general, a regional intrabasin allocation of the surface flow of the Santa Ana River System. The Santa Ana River Judgment leaves to each of the major hydrologic units within the basin the determination and regulation of individual rights therein and the development and implementation of its own water management plan subject only to compliance with the physical solution.

The Santa Ana River Judgment designates four public agencies to represent the interests of the Upper and Lower Areas and charges them with fulfilling the obligations set forth in the Santa Ana River Judgment, including implementation of the physical solution. The Lower Area is represented by OCWD. The Upper Area is represented by Valley District, Western, and Inland Empire Utilities Agency.

The court appoints a five-member Watermaster committee to administer the provisions of the Santa Ana River Judgment. The Watermaster's duty is to maintain a continuous accounting of each of the items listed in the letter of transmittal and to report annually for each water year to the court and the parties. The water year begins October 1 and ends the following September 30. The Santa Ana River Judgment specifies submission of the annual report 5 months after the end of the water year. The Watermaster requested that the time for submission be extended to 7 months after the end of the water year.

Each year, the Watermaster uses its long-established procedures to analyze the basic hydrologic and water quality data to determine (at Riverside Narrows and Prado Dam) base flow, base flow total dissolved solids (TDS), adjusted base flow, cumulative credits or debits to Upper Area parties, and the minimum required base flow for the following water year. The procedures include determining (for both locations) the amounts of nontributary flow or other flow to be excluded from base flow, the relative amounts of base flow and storm flow, and the relationships between electrical conductivity and TDS concentrations.

Watermaster determinations are made for Prado Dam as follows:

1. The components of flow at Prado Dam, which includes baseflow (42,000 acre-feet per year (AFY) minimum), storm flow, nontributary flow, and Arlington Desalter discharges, if any, to the river system
2. The adjusted base flow at Prado Dam credited to the Inland Empire Utilities Agency and Western.

Watermaster determinations are made for Riverside Narrows as follows:

1. The components of flow at Riverside Narrows, which includes base flow (15,250 AFY minimum), storm flow, and non-tributary flow
2. The adjusted base flow at Riverside Narrows credited to Valley District.

1.6.3 WATER QUALITY CONTROL PLAN FOR THE SANTA ANA BASIN

The Santa Ana Regional Water Quality Control Board (RWQCB) developed the *Water Quality Control Plan for the Santa Ana Basin* (Basin Plan) (2008) to protect and, where possible, enhance the quality of waters in the Santa Ana Basin, which includes the entirety of the Plan Area. The Basin Plan was developed specifically for the Santa Ana Basin and presents regional differences in existing water quality, the beneficial uses of the region's groundwater and surface water, and local water quality conditions and problems.

The Basin Plan for the Santa Ana Region includes statements of water quality goals and policies, descriptions of conditions, and discussions of solutions. It is also the basis for the RWQCB's regulatory programs. The Basin Plan establishes water quality standards for the region's groundwater and surface water. "Water quality standards," as used in the federal Clean Water Act, includes both the beneficial uses of specific water bodies and the levels of quality that must be met and maintained to protect those uses. The Basin Plan includes an implementation plan describing actions by the RWQCB and others necessary to achieve and maintain the water quality standards (RWQCB, 2008).

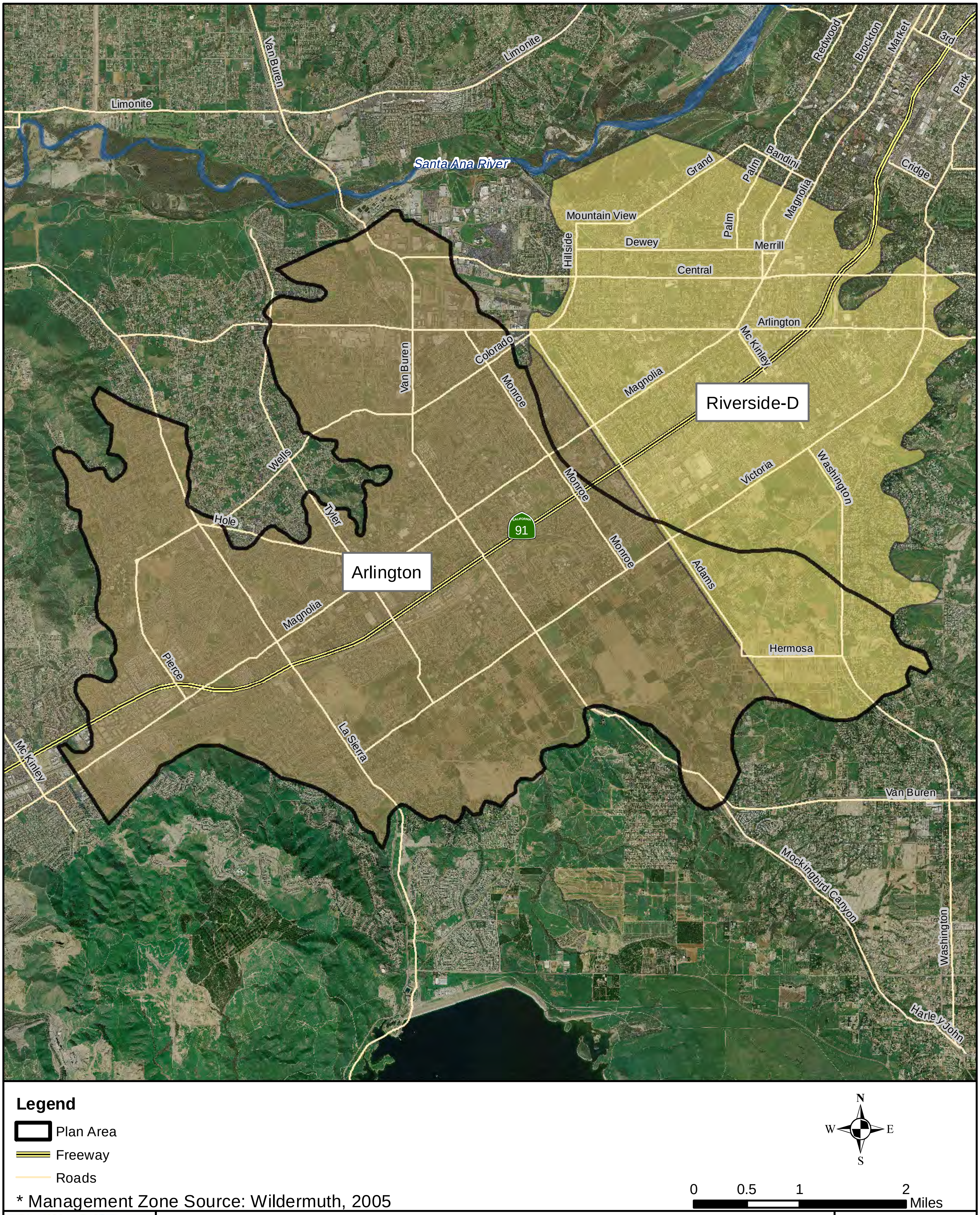
The plan was last updated in February 2008 to incorporate text from previous amendments and make other stylistic adjustments.

Notable from the viewpoint of groundwater management in the Plan Area are the Management Zone TDS and nitrate-nitrogen water quality objectives (amended by Resolution No. R8-2004-0001, January 22, 2004). The TDS and nitrate-nitrogen water quality objectives for each Management Zone are based on concentrations of TDS and nitrate-nitrogen from 1954 through 1973 and are referred to as the antidegradation objectives. One Management Zone, Arlington, covers the bulk of the Plan Area, with a smaller portion covered by Riverside-D, as shown on Figure 1.7. Additional information on TDS and nitrate-nitrogen concentrations in these Management Zones is provided in Section 2.3.6.

The RWQCB's principal means of achieving the water quality objectives and protecting the beneficial uses is development, adoption, issuance, and enforcement of waste discharge requirements. By regulating the quality of wastewaters discharged, and in other ways controlling the discharge of wastes that may impact surface and groundwater quality, the RWQCB works to protect the region's water resources. For TDS and nitrate-nitrogen, the objectives guide implementation of the regulations. The RWQCB's regulatory tools include National Pollutant Discharge Elimination System (NPDES) permits, waste discharge requirements, water reclamation requirements, water quality certification, and waste discharge prohibition. Permits for groundwater recharge involving recycled water are issued by the RWQCB, with recommendations from the California Department of Public Health (DPH).

1.6.4 Western Integrated Regional Water Management Plan

Western prepared an *Integrated Regional Water Management Plan* (IRWMP) (2008) to address long-range water supply planning to meet future demands in a rapidly growing area and to meet water supply reliability needs now and in the future. The IRWMP identifies and evaluates water management strategies that could increase local water supply, thereby improving water supply reliability. It also addresses local and regional water quality issues.



WESTERN MUNICIPAL WATER DISTRICT

Management Zones

Arlington Basin Groundwater Management Plan

2010

Figure 1.7

Western's member agencies and stakeholders identified approximately 90 loosely defined projects. These projects were refined, categorized, compared, and evaluated based on the following criteria:

- Project effectiveness
  - Providing new water supply
  - Improving water quality
  - Providing operational flexibility
  - Restoring ecosystems
- Support of water management strategies
  - Conservation
  - Conveyance and interties
  - Storage (through conjunctive use)
  - Groundwater management/ quality protection
  - Water supply
  - Recycled water production or delivery
  - Surface water management/ quality
  - Ecosystem protection/ restoration/ habitat enhancement/ wetlands restoration
  - Flood control
  - Land use planning
  - Recreation
- Project commitment
  - Readiness for implementation
  - Availability of local funds
- Other criteria
  - Serves disadvantaged communities
  - Provides regional benefits
  - Provides other benefits

The projects were grouped into three categories:

- Ready-Regional: Regional projects with adequate funding or planning progress to be implemented within the next 3 years
- Ready-Local: Local projects with adequate funding or planning progress to be implemented within the next 3 years
- Future Planning: Projects that need to acquire more funding to proceed, or are currently at a conceptual level

Of the Ready Projects, the following are of particular interest to the Plan Area:

- Ready-Regional
  - Riverside Pump Station #1 (Raub Regional Emergency Supply Project)
  - Riverside-Corona Feeder – Central Reach

    - Riverside-Corona Feeder – Southern Reach
    - Riverside/ Arlington Groundwater Basin Model
    - Western Water Use Efficiency Master Plan
- Ready-Local
    - Arlington Desalter expansion of 3.6 million gallons per day (mgd) (currently proposed project is up to 10.0 mgd)
    - System interconnections with the City of Riverside

1.6.5 Santa Ana Watershed Integrated Regional Water Management Plan

In 2009, the Santa Ana Watershed Project Authority (SAWPA), in cooperation with numerous stakeholders, completed an IRWMP for the Santa Ana Watershed, which includes the Arlington Basin. This IRWMP, called "One Water One Watershed" or OWOW, was developed to solve problems on a regional scale and give all water interests a voice in the planning process. The OWOW identifies four key threats to water resources in the region:

- Climate change resulting in reduced water supplies combined with increased water needs in the region
- Colorado River reductions of imported supply due to upper basin entitlements and continued long-term drought
- Sacramento-San Joaquin Delta vulnerability resulting in reductions or loss of supply due to catastrophic levee failure or changing management practices of the Sacramento-San Joaquin Delta
- Population growth and development resulting in interruptions in hydrology and groundwater recharge while increasing water needs

The OWOW looked toward 2030 to develop a vision for the Santa Ana Watershed that is drought-proofed, salt-balanced, and supports economic and environmental viability. Through a collaborative planning process, major needs were identified, that, if addressed, could have a significant and immediate impact on the water supplies for the future. These needs are as follows:

- Increase storage
- Recycle water
- Desalinate groundwater
- Consider stormwater as a water supply
- Develop risk-based water quality improvements

A project evaluation process for the OWOW Plan was completed to identify multi-benefit, multi-jurisdictional projects that meet the needs of the region. These projects will then move forward to compete for funding under Proposition 84, Chapter 2, which contains more than $1 billion for regions across the state for new water supply and water quality improvement projects. However, it is anticipated that these bond funds only will meet a fraction of the Santa Ana Watershed's needs. Remaining funding will be needed through the development of new partnerships and creative, multi-benefit projects to prepare the watershed for a sustainable future (SAWPA, 2010). The OWOW Plan is being updated and identification of additional implementable system-wide integrated projects and programs will be a part of the next update to assist in meeting the watershed plan goals.

1.6.6 METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA INTEGRATED WATER RESOURCES PLAN

Metropolitan Water District of Southern California (Metropolitan) developed an integrated resources plan (IRP) to establish regional targets for the development of water resources including conservation, local supplies, State Water Project (SWP) supplies, Colorado River Aqueduct supplies, and water drawn from regional storage and purchased through water transfers. These diverse supply sources are intended to provide regional supply reliability.

Metropolitan's IRP was developed in 1996 and updated in 2003 and again in 2010. The original IRP was developed as a two-phase process over a 2 ½-year period. Phase 1 included data collection, analysis, and decision-making. Major accomplishments during this phase were:

1. Defining resource management and business principles
2. Determining the reliability targets for the region
3. Projecting water demands
4. Identifying resource options

Phase 2 focused on developing a preferred resource mix and evaluating coordinated local water management efforts. Resource targets were developed for:

- Conservation
- Recycling, groundwater recovery, and seawater desalination
- SWP
- Colorado River Aqueduct
- In-region surface water storage
- In-region surface groundwater storage
- Central Valley/ SWP transfers and storage

The local project identified in the Plan Area is Western's Arlington Desalter Expansion. Metropolitan is supportive of the efficient management and use of local water resources such as the management envisioned in this plan (Metropolitan, 2004).

Metropolitan recently completed updating the plan; the update was approved on October 12, 2010. The 2010 IRP was developed to maintain traditional imported supplies from Northern California and the Colorado River while expanding local programs to meet future needs.

Projections in the 2010 IRP are through 2035, with conservation savings expected to be greater than any single source of supply (Metropolitan, 2010).

1.7 PUBLIC PROCESS IN DEVELOPING THE GROUNDWATER MANAGEMENT PLAN

The development of any GWMP is a collaborative process involving all interested stakeholders. Public input is critical to the success of the Arlington Basin GWMP and was a key component of its development.

The public was informed and encouraged to provide input and participate in the development of the GWMP in several forms:

- GWMP web site: **www.arlingtonplan.com** provided information to the public regarding the GWMP. Details about groundwater management in general and specific to the Plan Area were provided. Meeting dates, locations, and materials were posted along with details about the Advisory Committee and contact information.
- Newspaper advertisements in the *Riverside Press-Enterprise* gave notice of public hearings.
- Public hearings provided opportunities for personal communications that would be captured in the public record on specific topics, including resolutions of intent to draft a GWMP and resolution of adoption of the GWMP.
- Public meetings provided details on the GWMP process and solicited input.
- Advisory Committee meetings provided detailed technical information on the GWMP and solicited input.
- Direct communication by telephone, email, and mail was encouraged at meetings and on the web site. Comments could be sent to the Western project manager or the consultant project manager.

Key meetings, hearings, and other activities are summarized in the following sections.

1.7.1 NOVEMBER 5, 2008

A stakeholder meeting was held at 6 p.m. November 5, 2008 on the campus of California Baptist University in Riverside. The meeting was coordinated to include stakeholders in both the Plan Area and the Riverside Basin, which was concurrently undergoing the process of development of a GWMP. Letters were sent to stakeholders based on well ownership records of the Western-San Bernardino Watermaster and lists of local agencies. The letters provided information on the plan and invited participation in plan development. Letters were provided to:

- Agua Mansa Properties
- Roger Aguinaga Co., Inc.
- Alamo Water Company

- Box Springs Mutual Water Company
- Cal Baptist University
- California Portland Cement Company
- City of Colton
- City of Corona
- Corridor Land Company (Owl Resources)
- El Rivino Country Club
- Elsinore Valley Municipal Water District
- Gage Canal Company
- General American Transportation Company
- City of Grand Terrace
- Green Acres
- Green Acres Memorial Park Association
- Holliday Trucking
- Home Gardens
- Indian Hills Country Club
- Jurupa Community Services District
- La Sierra University
- Loring Ranch 31503 LP
- Loving Homes Greens Homeowners
- Meeks & Daley Water Company
- Merryfield Water Company
- Montecito Memorial Park
- City of Norco
- Rapid Infiltration and Extraction Facility
- Reche Canyon Mutual Water Company
- City of Riverside Parks and Recreation
- Riverside Canal Power Co.
- Riverside Cement Company
- Riverside County Flood Control & Water Conservation District
- Riverside County Parks Department
- Riverside Highland Water Company
- Riverside Public Utilities
- Rubidoux Community Services District
- RWQCB
- SAWPA
- Tri-County Linen Supply
- Universal Forest Products
- University of California, Riverside
- USGS
- Victoria Country Club
- West Riverside 350 Water Company
- West Valley Water District
- Western-San Bernardino Watermaster
- Yeager, Reidman & Horn

The meeting was open to the public and well attended. Organizations represented at the meeting, according to the sign-in sheet, included:

- Agua Mansa Properties
- Alamo Water Company
- California Portland Cement Company
- California Baptist University
- City of Corona
- Elsinore Valley Municipal Water District
- GFB & Associates
- Gage Canal Company
- Jurupa Community Services District
- Riverside County Parks Department
- Riverside County Flood Control and Water Conservation District
- Riverside Public Utilities
- Rubidoux Community Services District
- City of San Bernardino Municipal Water Department
- Tri-City Linen
- Victoria Club
- Western Municipal Water District
- Western-San Bernardino Watermaster

A presentation was given describing GWMPs, including the components, benefits, and the procedures. The Advisory Committee was introduced and interested parties were invited to join the committee. The importance of stakeholder participation was stressed and the various options for participation were described. The concepts of basin goals and BMOs were discussed with potential options for the basin. Stakeholder input was solicited on all items and a question-and-answer period allowed for response to stakeholder questions and concerns.

1.7.2 NOVEMBER 19, 2008

A public hearing was held at 9:30 a.m. on November 19, 2008 at Western's offices in Riverside. The public was notified through two advertisements in the *Riverside Press-Enterprise* on November 5, 2008 and November 12, 2008. The advertisement was a written statement provided to the public describing the manner in which interested parties may participate in developing this GWMP. At the hearing, the Western Board of Directors conducted the initial public hearing regarding Western's intent to draft a GWMP for the Plan Area in accordance with the requirements of Water Code Section 10750 et. seq. and to receive public comment regarding the intention to draft the GWMP. Discussion at the hearing included a presentation to the board and the public by General Manager John Rossi describing the GWMP, including the components, benefits, procedures, and opportunities for public input. Public comments were solicited, but none were given at the hearing. The Board adopted the resolution of intention to draft the GWMP as Resolution Number 2570. The resolution was advertised in the *Riverside Press-Enterprise* on January 22, 2009 and January 29, 2009. The advertisements and minutes are included in Appendix A.

1.7.3 MARCH 18, 2009

An Advisory Committee meeting was held on March 18, 2009 at the offices of RPU to discuss:

- Why the GWMP is being developed
- How the GWMP would affect other agencies or other stakeholders
- What are the goals and objectives of the GWMP
- What are the next steps in developing the GWMP

A presentation was given followed by a question-and-answer period. The meeting, which also included discussions of the Riverside Basin GWMP, was attended by representatives of:

- City of Colton
- City of San Bernardino Municipal Water Department
- Jurupa Community Services District
- Riverside Public Utilities
- Western

1.7.4 AUGUST 3, 2010

Stakeholders and Advisory Committee members were provided a copy of the draft Sections 1-4 to develop a common understanding of the basin conditions prior to developing the remainder of the document. The draft Sections 1-4 were provided to the following on August 3, 2010:

- California Baptist University
- City of Corona
- Gage Canal Company
- Home Gardens County Water District
- La Sierra University
- Lordan Management
- Loving Homes Greens Homeowners
- City of Norco
- Riverside County Flood Control & Water Conservation District
- City of Riverside Parks and Recreation
- RPU
- RWQCB
- SAWPA
- Sherman Indian High School
- USGS
- Valley District
- Watermaster Support Services

Comments were received and incorporated into the draft document.

1.7.5 OCTOBER 12, 2010

Stakeholders and Advisory Committee members were provided a copy of the draft GWMP for review and comment on October 12, 2010. Copies provided to the following:

- California Baptist University
- City of Corona
- Gage Canal Company

- Home Gardens County Water District
- La Sierra University
- Lordan Management
- Loving Homes Greens Homeowners
- City of Norco
- Riverside County Flood Control & Water Conservation District
- City of Riverside Parks and Recreation
- RPU
- RWQCB
- SAWPA
- Sherman Indian High School
- USGS
- Valley District
- Watermaster Support Services

Comments were received and were incorporated into the GWMP

1.7.6 NOVEMBER 3, 2010

A public hearing was held at 9:30 a.m. on November 3, 2010 at Western's offices in Riverside to renotify the public of the development of the GWMP. The public was notified through two advertisements in the *Riverside Press-Enterprise* on October 21, 2008 and October 28, 2010. The advertisement was a written statement provided to the public describing the manner in which interested parties may participate in developing this GWMP. At the hearing, the Western Board of Directors conducted a public hearing regarding Western's intent to draft a GWMP for the Plan Area in accordance with the requirements of Water Code Section 10750 et. seq. and to receive public comment regarding the intention to draft the GWMP. The components, benefits, procedures, and opportunities for public input in the GWMP were discussed. Public comments were solicited, but none were given at the hearing. The Board adopted the resolution of intention to draft the GWMP as Resolution Number 2694. The resolution was advertised in the *Riverside Press-Enterprise* on February 8, 2011 and February 15, 2011. The advertisements and minutes are included in Appendix A.

1.7.7 OCTOBER 26, 2011

A stakeholder meeting was held at 6 p.m. October 26, 2011 on the campus of California Baptist University in Riverside. The public was invited to attend the meeting, including letters to previously identified stakeholders:

- California Baptist University
- City of Corona
- Gage Canal Company
- Home Gardens County Water District
- La Sierra University
- Lordan Management
- Loving Homes Greens Homeowners

- City of Norco
- Riverside County Flood Control & Water Conservation District
- City of Riverside Parks and Recreation
- RPU
- RWQCB
- SAWPA
- Sherman Indian High School
- USGS
- Valley District
- Watermaster Support Services

The draft GWMP was summarized in a presentation. The presentation included the water resource conditions in the basin, water requirements and supplies, goals, objectives, elements, and implementation. The stakeholders were provided an additional opportunity to provide comments on the GWMP or to request additional time to provide comments. No additional comments or requests for additional time for review were received.

The meeting was attended by representatives of:

- California Baptist University
- Riverside County Flood Control and Water Conservation District
- Riverside Public Utilities
- Riverwalk
- Valley District
- Watermaster Support Services
- Western

1.7.8 DECEMBER 21, 2011

A public hearing was held at 9:30am on December 21, 2011 at Western's offices at 14205 Meridian Parkway in Riverside. The public was notified through two advertisements in the *Riverside Press-Enterprise* on December 7, 2011 and December 14, 2011. At the hearing, the Western Board of Directors conducted a public hearing regarding Western's adoption of this GWMP for the Plan Area in accordance with the requirements of Water Code Section 10750 et. seq. and to receive public comment regarding the intention to adopt the GWMP. Discussion at the hearing included a presentation to the Board of Directors and the public which included a summary of the plan, including the components, benefits, and implementation. The presentation included information for the public that copies of the plan may be obtained for the cost of reproduction at Western's offices in Riverside. The Board of Directors adopted a resolution to adopt the GWMP. The advertisements and the resolution are included in Appendix A.

1.8 ADVISORY COMMITTEE

The Arlington Basin GWMP Advisory Committee was organized to solicit input and direct the development of the GWMP. Agencies were invited to send representatives to participate in the Advisory Committee. Other stakeholders were invited to join through the public notification process, including hearings, letters, the web site, and public meetings. Mr. Tom Field of RPU and Mr. Fakhri Manghi of Western attended the Advisory Committee meetings. Other agencies were invited to attend. Meetings and regular conference calls were held from late 2008 through early 2011 to coordinate stakeholder input and incrementally build the GWMP. Advisory Committee members also received draft text during the development of the GWMP and their comments were incorporated into the document.

1.9 ARLINGTON BASIN GWMP AND CONSISTENCY WITH CALIFORNIA WATER CODE

Groundwater management is the planned and coordinated local effort of sustaining the groundwater basin in order to meet future water supply needs. With the passage of AB 3030 in 1992, local water agencies were provided a systematic way of formulating GWMPs (California Water Code, § 10750 et. seq.). Senate Bill 1938, passed in 2002, further emphasizes the need for groundwater management in California. It requires AB 3030 GWMPs to contain specific plan components to be eligible to receive state funding for water projects. The Arlington Basin GWMP includes the seven components that are required to be eligible for DWR funds for the construction of groundwater projects or groundwater quality projects. The GWMP also addresses the 12 specific technical issues identified in the Water Code along with the seven recommended components identified in DWR Bulletin 118-03 (DWR, 2003). Table 1.1 lists the required and recommended components and identifies the specific section of this GWMP in which the components are discussed.

Table 1.1 Arlington Basin Groundwater Management Plan Components

Component	GWMP Section(s)
SB1938 Mandatory	
1. Documentation of public involvement	1.7
2. BMOs	5.3
3. Monitoring and management of groundwater elevations, groundwater quality, inelastic land subsidence, and changes in surface water flows and quality that directly affect groundwater levels or quality	6.3
4. Plan to involve other agencies located in the groundwater basin	6.4
5. Adoption of monitoring protocols	6.3, App. E
6. Map of groundwater basin boundary, as delineated by DWR Bulletin 118, with agencies' boundaries that are subject to GWMP	Figures 1.1, 1.2, and 1.3
7. For agencies not overlying groundwater basins, GWMP prepared using appropriate geologic and hydrogeologic principles	n/ a
AB 3030 and SB 1938 Voluntary	
1. Control of saline water intrusion	6.2.1
2. Identification and management of well protection and recharge areas	6.2.2
3. Regulation of the migration of contaminated groundwater	6.2.3
4. Administration of well abandonment and destruction program	6.2.4
5. Control and mitigation of groundwater overdraft	1.1.1
6. Replenishment of groundwater	6.1.2
7. Monitoring of groundwater levels	6.3.1
8. Development and operation of conjunctive use projects	6.1.3
9. Identification of well construction policies	6.2.5
10. Construction and operation of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects	6.2.6
11. Development of relationships with state and federal regulatory agencies	6.4.2
12. Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination	6.4.4
DWR Bulletin 118 Recommended	
1. Management with guidance of Advisory Committee	1.7, 1.8, 6.4.1
2. Description of area to be managed under GWMP	1.2
3. Links between BMOs and goals and actions of GWMP	5
4. Description of GWMP monitoring programs	6.3, App. E
5. Description of integrated water management planning efforts	1.6, 6.4.3
6. Report of implementation of GWMP	6.4.5
7. Periodic evaluation of GWMP	6.4.5

2.1 CLIMATE

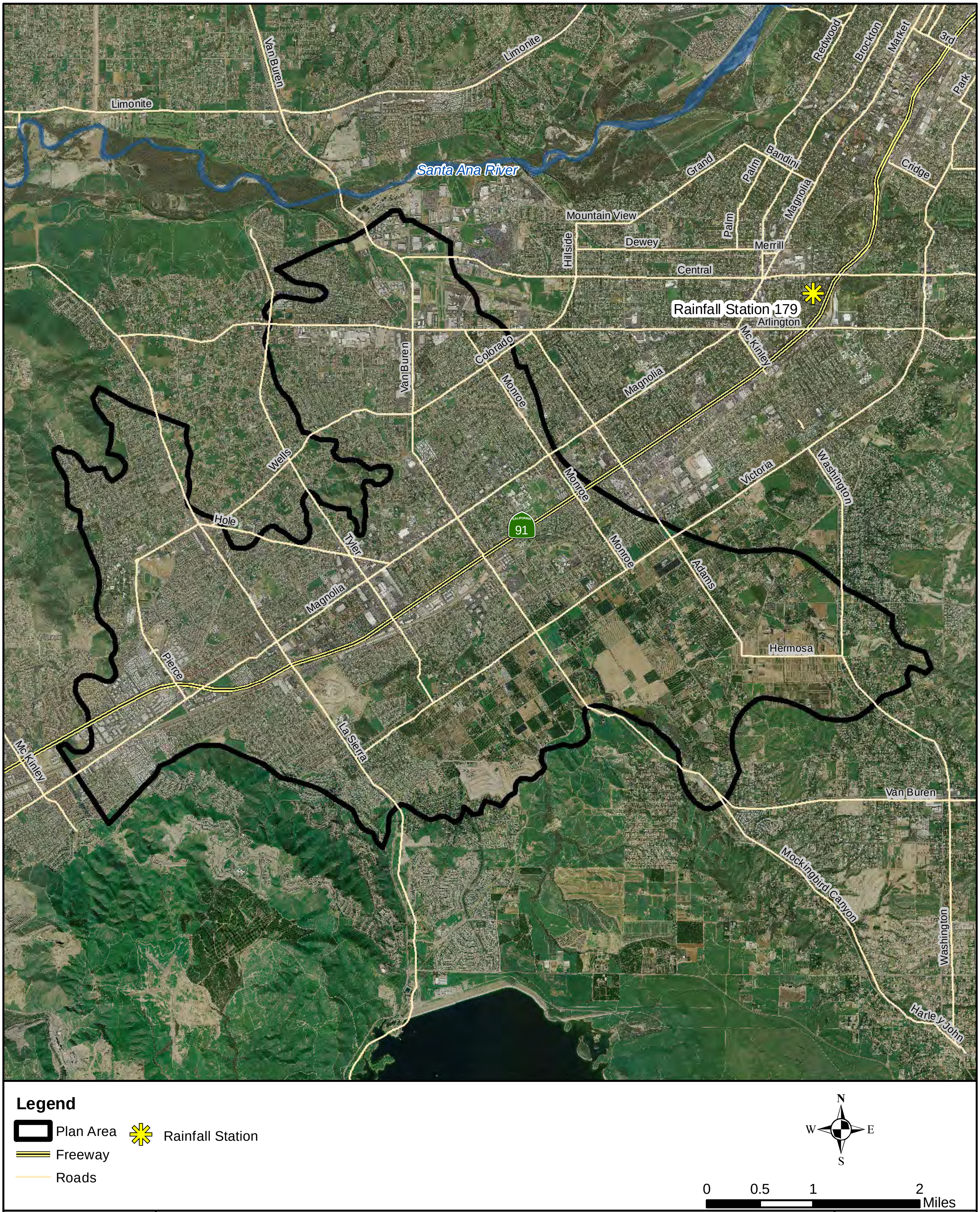
The Plan Area is located in a semi-arid area region characterized by dry, hot summers and precipitation concentrated during mild winters. This climate results in significantly higher water demand in the summer than in the winter. Average monthly temperature and reference evapotranspiration data are shown in Table 2.1.

Table 2.1 Average Monthly Temperature and Reference Evapotranspiration

Parameter	Month												Annual
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Average Maximum Temperature (°F)*	66.4	67.9	70.2	75.0	79.5	86.6	93.9	94.4	90.6	82.5	73.5	67.5	79.0
Average Minimum Temperature (°F)*	41.6	43.3	45.0	47.9	52.6	56.3	60.7	61.3	58.4	52.5	45.5	41.3	50.5
Average Reference Evapotranspiration (inches [in])**	2.49	2.91	4.16	5.27	5.94	6.56	7.22	6.92	5.35	4.05	2.94	2.56	56.37

* Source: Western Regional Climate Center, 2009. Riverside Citrus Experiment Station. Period of record July 1948 – December 2008. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7473
** Source: California Irrigation Management System. 2009. 44 UCR Riverside. Period of record June 1985 – February 2009. http://www.cimis.water.ca.gov/cimis/monthlyEToReport.do; June 1985 – February 2009

The Riverside County Flood Control and Water Conservation District (RCFCWCD) collects precipitation data at Station 179 and several other stations. Station 179 is located at the City of Riverside Fire Station #3 on Riverside Avenue, just north of the Plan Area near the intersection of Highway 91 and Central Avenue (Figure 2.1). Data from Station 179 are considered reliable and high-quality with a long period of record. Station 179 precipitation data provided by RCFCWCD includes daily data from 1881 to 2009. The annual average precipitation and the cumulative departure from annual average at Station 179 are shown on Figure 2.2. The cumulative departure from annual average shows the accumulation, since 1880, of the differences (departures) in annual total precipitation from the average value for each year for the period of record; a rising line represents wetter-than-normal conditions while a falling line represents drier-than-normal conditions. The long-term average annual precipitation for the period from 1881 to 2009 is 10.5 inches.



WESTERN MUNICIPAL WATER DISTRICT

Rainfall Station 179

Arlington Basin Groundwater Management Plan

2010

Figure 2.1

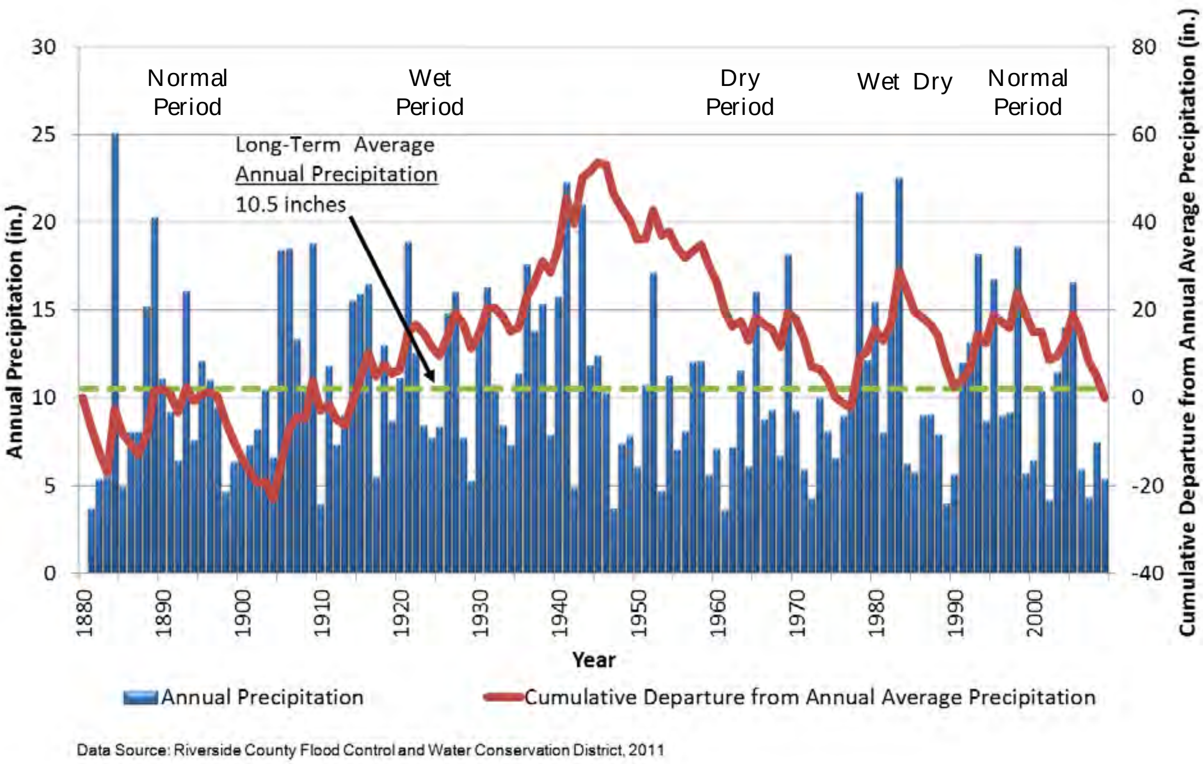


Figure 2.2 Historical Annual Precipitation and Cumulative Departure from Annual Average Precipitation

The cumulative departure from annual average precipitation chart shows an extended wet period from 1905 through the mid-1940s, followed by an extended dry period through the mid-1970s. Wet and dry periods have an impact on water supplies and water demands. In dry periods, groundwater quantities in the Arlington Basin and surrounding basins is impacted by reduced recharge from reduced precipitation and the associated reduced surface water flows. Wet periods have the opposite effect, increasing recharge to the basin. Demand is also impacted by precipitation, with increased demands due to evapotranspiration during dry periods occurring simultaneously with increased voluntary and mandatory conservation efforts.

Figure 2.3 shows the long-term average monthly precipitation at Station 179. Most precipitation occurs during the mild winters, from November through April.

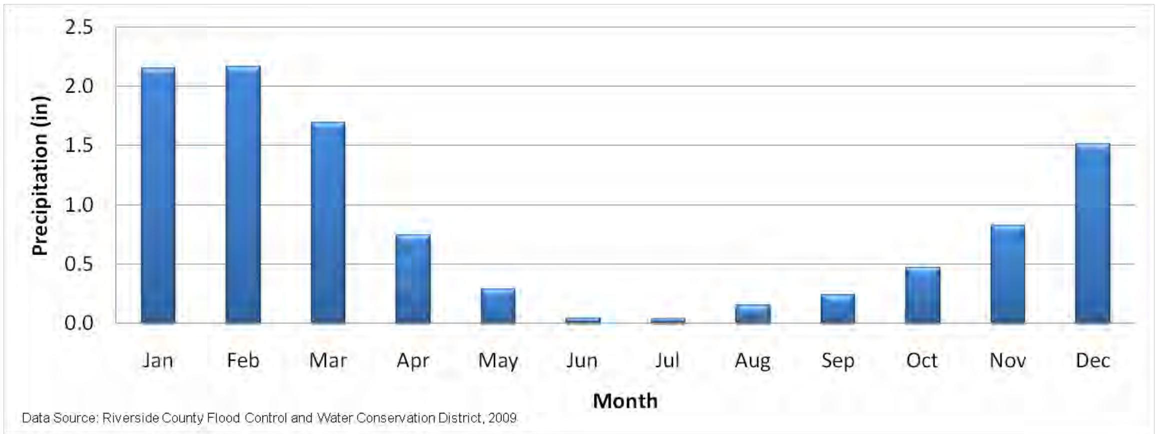


Figure 2.3 Average Monthly Precipitation

2.2 SURFACE WATER

There are no major surface water bodies in the Plan Area. Smaller surface water bodies include several flood control basins and the partially lined Arlington, La Sierra, and Arizona flood control channels operated by RCFCWCD.

2.3 GROUNDWATER

Groundwater is produced from the alluvial sediments in the Plan Area. Recharge to the basin occurs from precipitation, applied water, and recharge from the surrounding watersheds. Water quality is poor, particularly with respect to ambient water quality related to TDS (on average greater than 950 milligrams per liter [mg/ L]) and nitrate (on average greater than 20 mg/ L, as nitrogen). Total dissolved solids and nitrate concentrations have shown little long-term variability since at least the 1950s (Wildermuth Environmental, Inc. [Wildermuth], 2008b). Additional details are provided in the following sections.

2.3.1 GEOLOGIC SETTING

The Plan Area is located within the Perris Block of the northern Peninsular Ranges. The Peninsular Ranges are northwest oriented mountain ranges and faults extending from the Los Angeles Basin to the tip of Baja California. The Arlington Basin is an alluvium filled feature between such mountain ranges. (DWR, 2003; Harden, 1998; Woodford et al, 1971). The boundaries shown on Figure 1.1, are delineated by the impermeable rocks of Box Springs Mountains to the east, Arlington Mountain to the south, Arlington Narrows to the southwest, the La Sierra Heights to the northwest (DWR, 2003), and a surface water flow divide to the north.

2.3.2 Water-Bearing Formations

Groundwater in the Plan Area is generally unconfined and found in alluvial deposits of depths up to 250 feet in the center of the basin. The deposits are continuous with the Riverside Basin deposits to the northeast and the Temescal Basin deposits to the southwest. The Quaternary Period alluvial deposits consist of gravel, sand, silt, and clay. These materials were deposited by the ancestral Santa Ana River and other surface channels in a bedrock canyon formed by ancient drainage systems running from south to north, emptying into the main portion of the Santa Ana Basin near Colton (Eckis, 1934).

For specific details on the water-bearing formations, a three-dimensional hydrostratigraphic model (3-D model) of the Plan Area and surrounding area was created by Numeric Solutions, LLC (2010), for use in developing a single groundwater model, RAGFM, for the Riverside and Arlington Basins. This model is discussed in further detail in Section 1.3 and in WRIME (2011a). The 3-D model was based on available drillers' logs, which were coded with depth based on lithology. Interpolation was performed by kriging to develop the 3-D model from ground surface to bedrock. Detailed cross-sections of the alluvial basin from the 3-D model are included in Appendix B.

2.3.3 Soils

Surface soils impact the amount of water that infiltrates to groundwater as opposed to contributing to surface runoff. A relevant soil classification used by the United States Department of Agriculture Natural Resources Conservation Service for hydrology is the hydrologic soil group. The hydrologic soil group can be used to estimate the amount of infiltration that can be expected from specific soil types. This can be useful for determining areas of natural recharge or areas suitable for artificial recharge facilities. The grouping was developed from water intake estimates during the latter part of a storm of long duration, after the soil profile is wet and has an opportunity to swell, without the protective effect of any vegetation. Also considered are depths to the seasonal high water table and to a low permeability layer. The classification is useful at a planning level, but detailed studies are required for a thorough understanding of the infiltration capacity of soils. Features such as slope, ground cover, or low permeability subsurface materials away from the upper soil profile may impact the soil's capability to infiltrate water. Under the hydrologic soil group classification system, soils are grouped A to D with A having the lowest runoff potential (highest infiltration rates) and D having the highest runoff potential (lowest infiltration rates), as summarized in Table 2.2.

Table 2.2 – Characteristics of Hydrologic Soil Groups

Soil Group	Characteristics
Group A	Sand, loamy sand, or sandy loam, low runoff potential and high infiltration rate. Primarily deep, well drained soils with high sand or gravel content.
Group B	Silt loam or loam, moderate infiltration rate when thoroughly wetted. Mostly deep to moderately deep, well drained soils with moderate to low sand content.
Group C	Sandy clay loam, low infiltration rates when thoroughly wetted. Fine to moderately fine texture, often with layers that block downward movement of water.
Group D	Clay loam, silty clay loam, sandy clay, silty clay, or clay. Very fine texture with high runoff potential and low infiltration rates. Often very shallow, over bedrock or high water table.

A map of hydrologic soils groups is provided on Figure 2.4 (Knecht, 1971). In the Plan Area, there are few high permeability A soils. B soils are found through a large portion of the basin, generally along the southwest-northeast basin axis. Soils southeast of Highway 91 are a mix of B and C soils while D soils are in the northwestern portion of the basin, in the vicinity of Van Buren Boulevard and Arlington Avenue. Hydrologic soils group information may be used as one criteria for identification of areas suitable for artificial recharge of groundwater, protection of existing natural recharge areas, or identification of areas vulnerable to groundwater contamination.

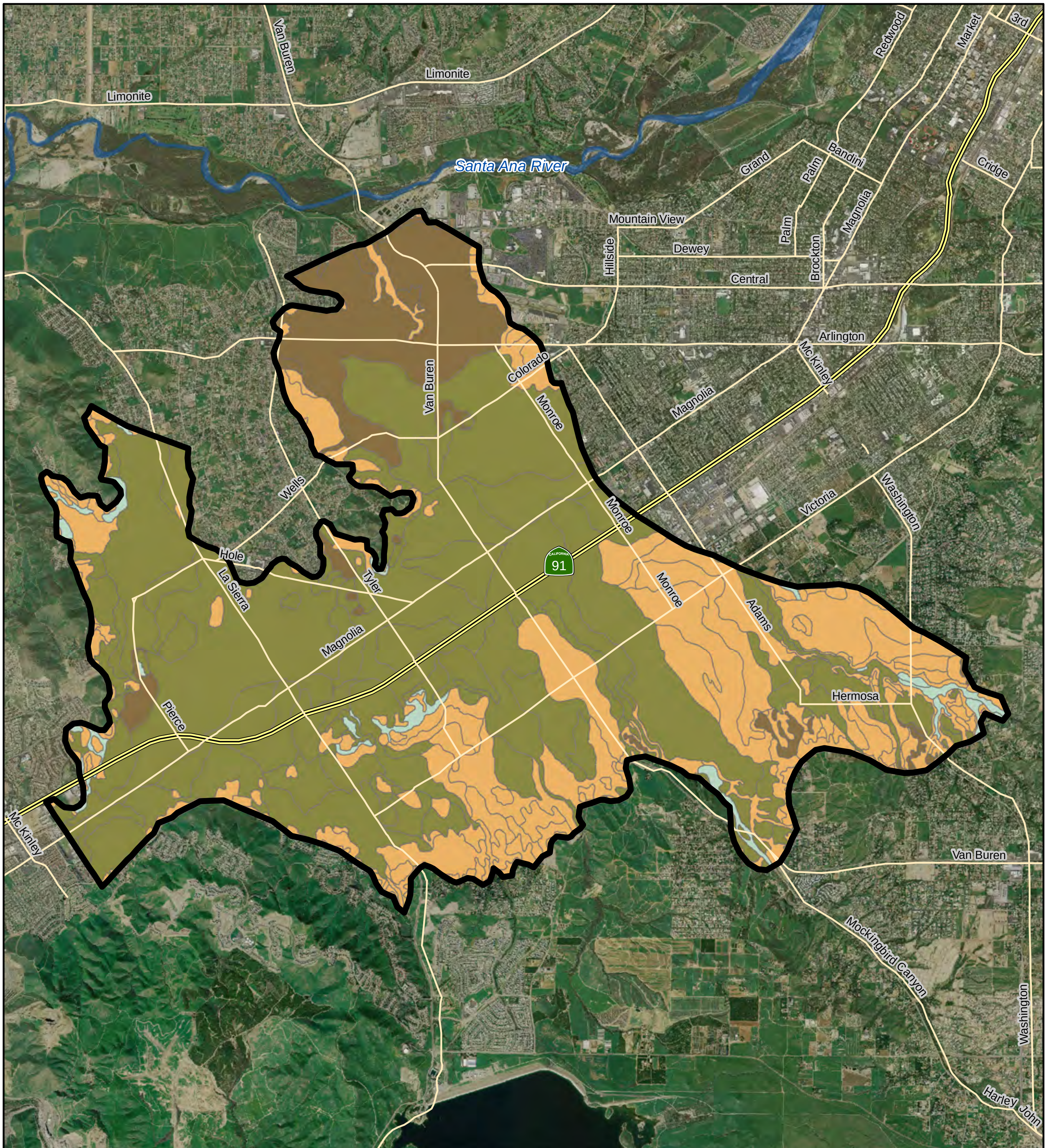
2.3.4 HISTORICAL DEVELOPMENT PATTERNS

Significant early groundwater development in the Arlington area coincides with the beginnings of the citrus industry. In the 1880s, citrus growers in the Arlington area began growing a new variety of orange from Bahia, Brazil. The rapid dominance of this variety, known as the Washington Naval Orange, in the 1890s resulted in great wealth for the Arlington area, and increased the demand for irrigation water to provide consistent, high-quality water to the trees (Lawton and Weathers, 1989).

Land use changed in the post-World War II era as urbanization replaced much of the citrus groves with residential, commercial, and industrial development. The shift from agricultural to urban uses resulted in different water demand patterns, water return flows to the aquifer, and water quality needs. Further discussion of more recent water supplies can be found in Section 3, Water Requirements and Supplies.

2.3.5 GROUNDWATER LEVELS

As discussed previously, land use patterns and water demands in the Plan Area have changed over the years as the once dominant agriculture gave way to increasing urbanization. In spite of these changes, flow patterns today remain similar to those in the 1930s. Figure 2.5 shows recent groundwater levels from fall 2009. Figure 2.6 compares water levels in January 1933 (Eckis, 1934) to fall 2009 (Western and Watermaster Support Services, 2010), showing that the recent water levels are generally within 0 to -40 feet of the water levels approximately 80 years ago with similar flow patterns toward Arlington Narrows. The historical precipitation data on Figure 2.2 shows that January 1933 was toward the end of a long wet period. The 1933 time period also followed the introduction of imported water for irrigation of the citrus trees. The imported water resulted in a rise in groundwater levels and a shift in flow direction. Prior to development and associated irrigation, groundwater flow was likely toward the Riverside Basin, while in the 1930s (Eckis, 1934) and today groundwater flow is toward the southwest through the Arlington Gap. Hydrographs of water levels at 3 selected wells, shown on Figures 2.7 and 2.8, demonstrate water level changes over time through different hydrologic conditions. Generally, these hydrographs show increasing water levels starting around 1960 and stabilizing or declining somewhat after the 1980s.



Legend

Plan Area	**Hydrologic Soil Group (Runoff / Infiltration Potential)***	
Freeway	A (Very Low / High)	
Roads	B (Low / Moderate)	
	C (Moderate / Low)	
	D (High / Very Low)	

N
W E
S

*Soil Survey Geographic (SSURGO) database for Western Riverside Area, California.
U.S. Department of Agriculture, Natural Resources Conservation Service, 2008

0 0.5 1 2 Miles

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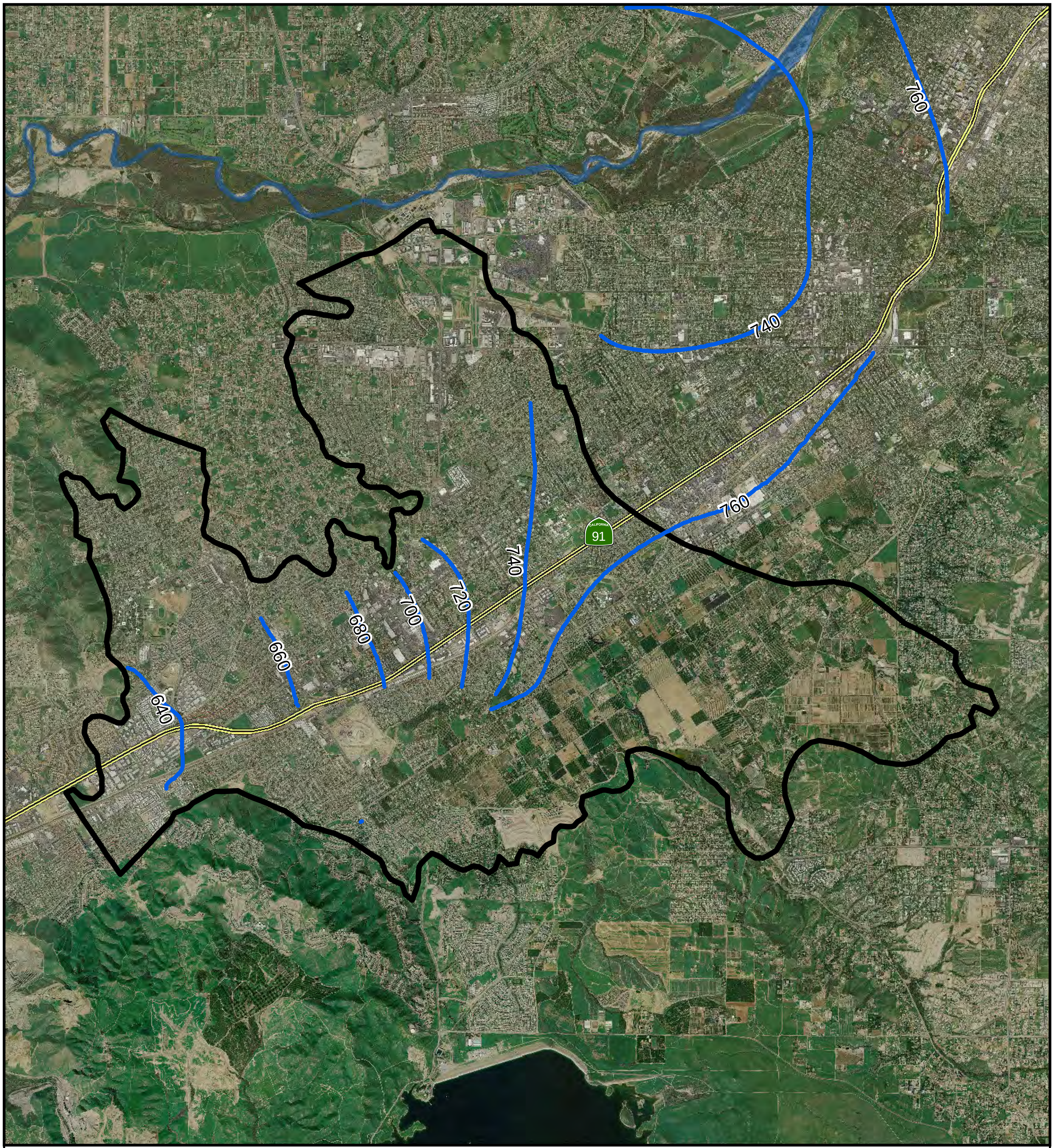
Hydrologic Soil Groups

Arlington Basin Groundwater Management Plan

2010

Figure 2.4



Legend

- Plan Area
- Santa Ana River
- Freeway
- Fall 2009 Water Levels (ft MSL)*

N
W E
S

0 0.5 1 2 Miles

*Fall 2009 Groundwater Elevation from Watermaster database, 2010.

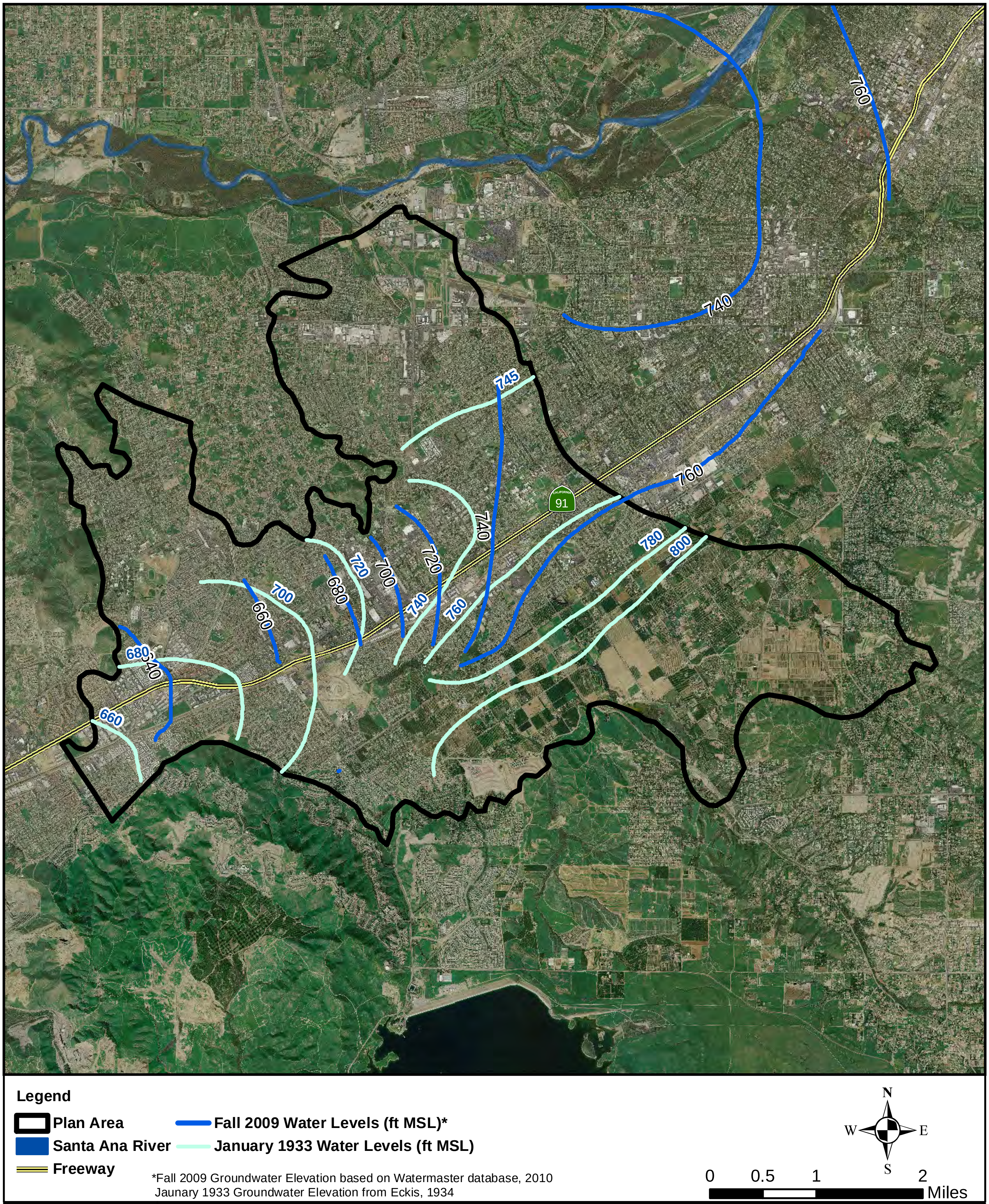
WESTERN MUNICIPAL WATER DISTRICT

Fall 2009 Groundwater Levels

Arlington Basin Groundwater Management Plan

2010

Figure 2.5



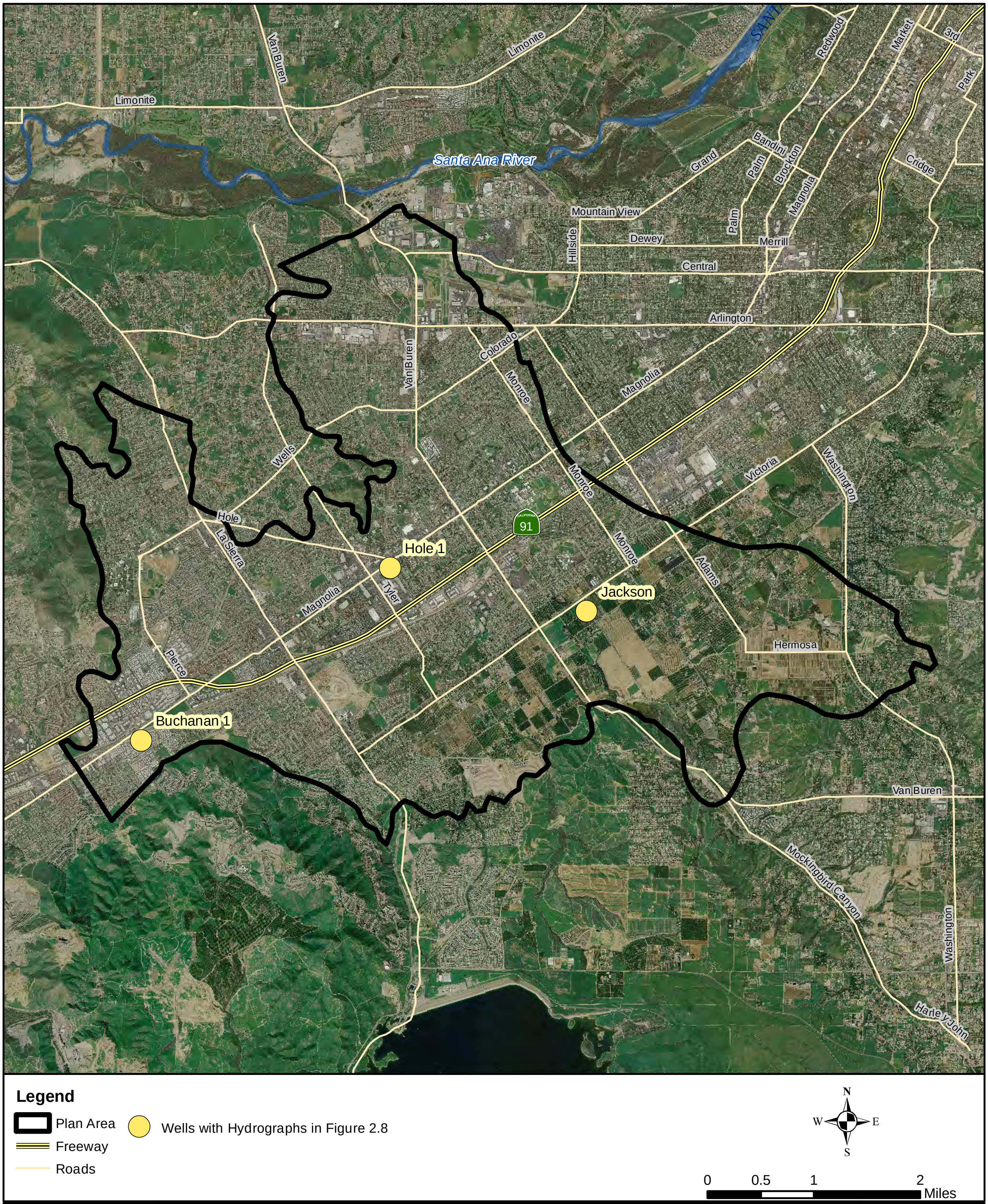
WESTERN MUNICIPAL WATER DISTRICT

Comparison of Recent and Historical Groundwater Elevations

Arlington Basin Groundwater Management Plan

2010

Figure 2.6



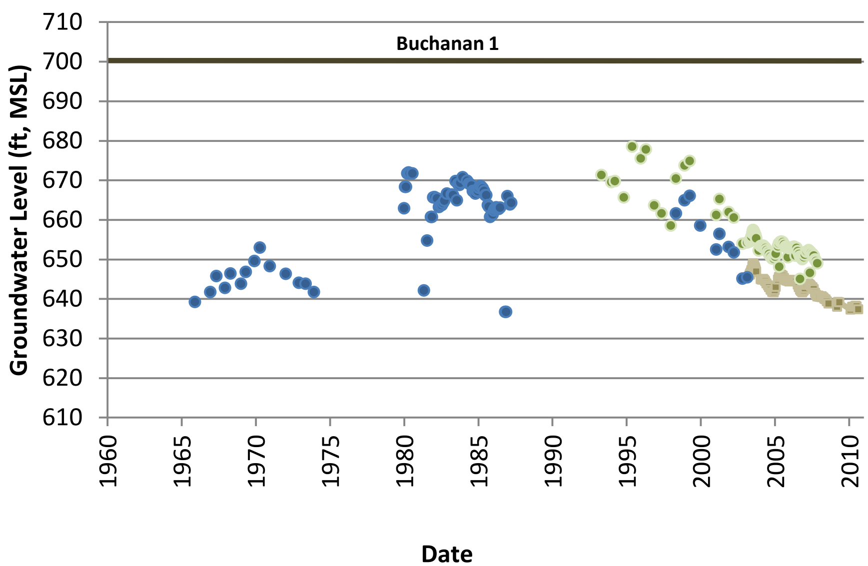
WESTERN MUNICIPAL WATER DISTRICT

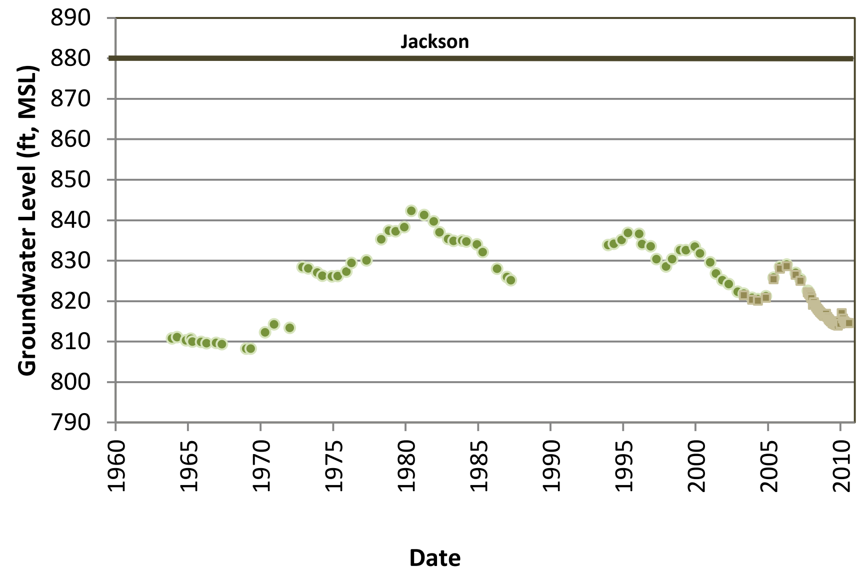
Hydrograph Locations

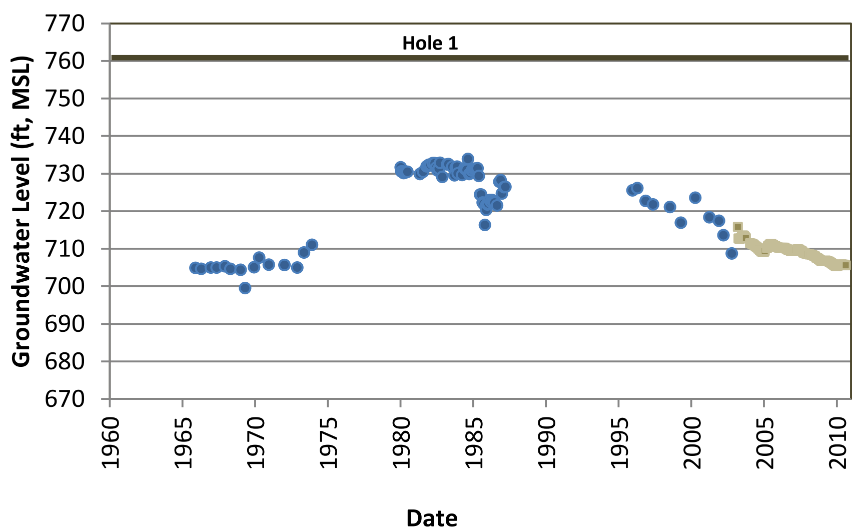
Arlington Basin Groundwater Management Plan

2010

Figure 2.7







Ground surface elevation - approximate, based on USGS digital elevation model
Groundwater level from SABRINA database
Groundwater level from AWQ database
Groundwater level from Cooperative Well Measurement Program database

WESTERN MUNICIPAL WATER DISTRICT

Selected Hydrographs

Arlington Basin Groundwater Management Plan

2010

Figure 2.8

2.3.6 GROUNDWATER QUALITY

In general, groundwater quality in the Plan Area is poor, with high TDS and nitrate concentrations (Wildermuth, 2008b). Overall groundwater quality concerns in the Plan Area, reflecting all groundwater in its untreated state, generally focus on regional non-point issues with nitrates and TDS.

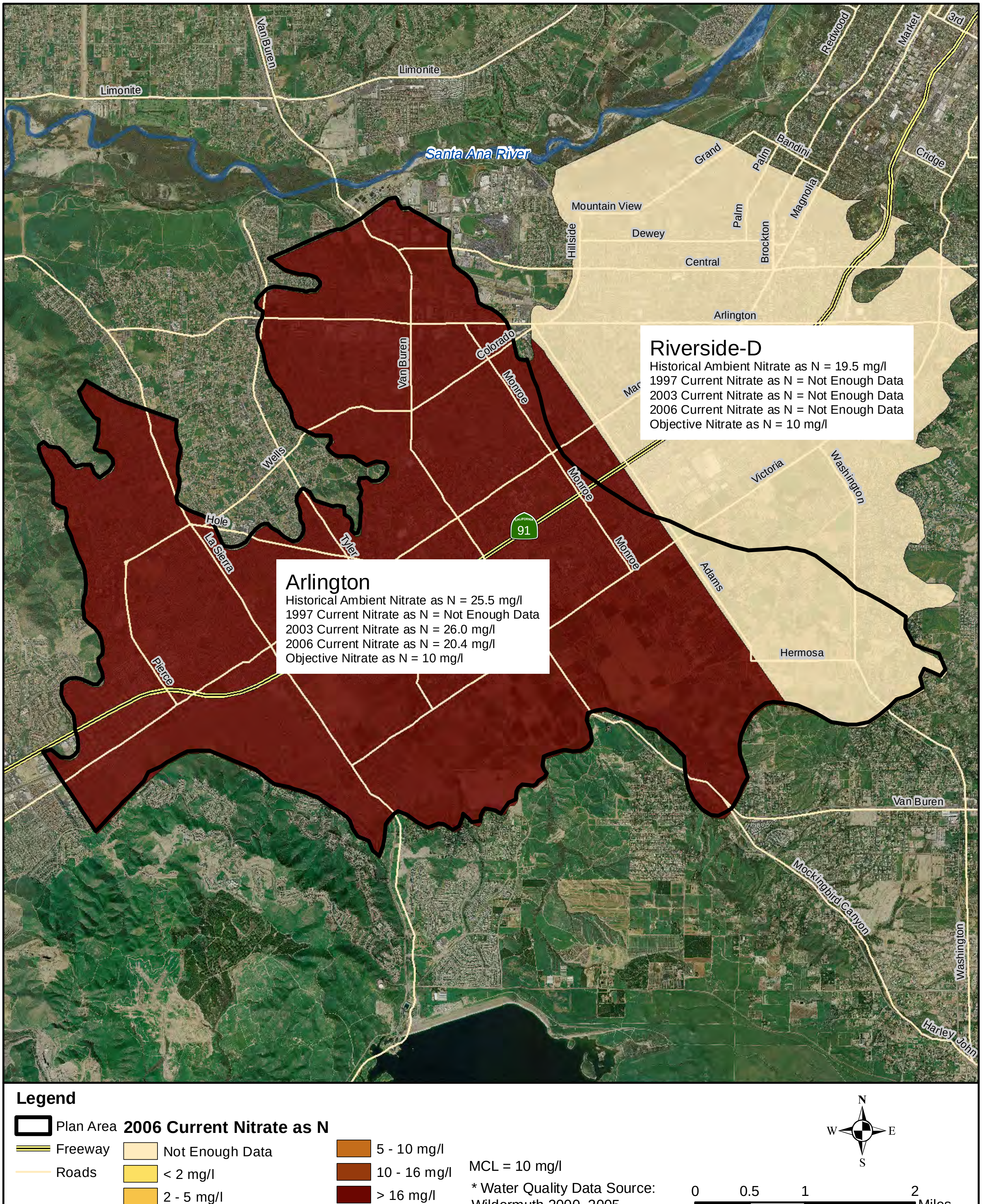
The Plan Area lies within the jurisdiction of the RWQCB, whose Basin Plan establishes the legal beneficial use designations and sets the standards to protect these uses. The Basin Plan incorporates a TDS and Nitrogen Management Plan for the Santa Ana Region, which includes the upper and lower Santa Ana River Watersheds, the San Jacinto River Watershed, and several other small drainage areas.

Within the Santa Ana watershed, which includes the Plan Area, a statistical method has been developed to use nitrate as nitrogen (N) and TDS to evaluate the status of water quality, to compare sub-basin concentrations, and to trigger management actions (RWQCB, 2004; Wildermuth, 2000, 2005, 2008b). Point statistics were used to show:

1. Historical ambient water quality conditions as represented by the 1954-1973 time period
2. 1997 Current ambient water quality conditions as represented by the 1978-1997 time period
3. 2003 Current ambient water quality conditions as represented by the 1984-2003 time period
4. 2006 Current ambient water quality conditions as represented by the 1987-2006 time period.

These point statistics were developed for Management Zones defined within the Basin Plan. The Plan Area is divided by the Basin Plan into two Management Zones, Arlington and a small portion of Riverside D, as shown on Figure 1.7. The boundaries were designed to provide "hydrologically-distinct groundwater units from a groundwater flow and water quality perspective. As such, lines delineating Management Zones were placed along impermeable barriers to groundwater flow, at bedrock constrictions, and between distinct flow systems" (Wildermuth, 2000). The boundary between Riverside D and Arlington Basin is based on a groundwater divide that is not fixed and may migrate due to recharge and extraction operations in the area. The location of the two Management Zones is shown with the water quality summaries on Figure 2.9a and Figure 2.9b.

A summary of the data is shown in Table 2.3 and on Figures 2.9a and 2.9b, indicating nitrate as N levels exceeding the Basin Plan Objective and maximum contaminant level (MCL) of 10 mg/L in Arlington for three time periods and in Riverside D for the Historical time period. Insufficient nitrate as N data are available for the other time periods.



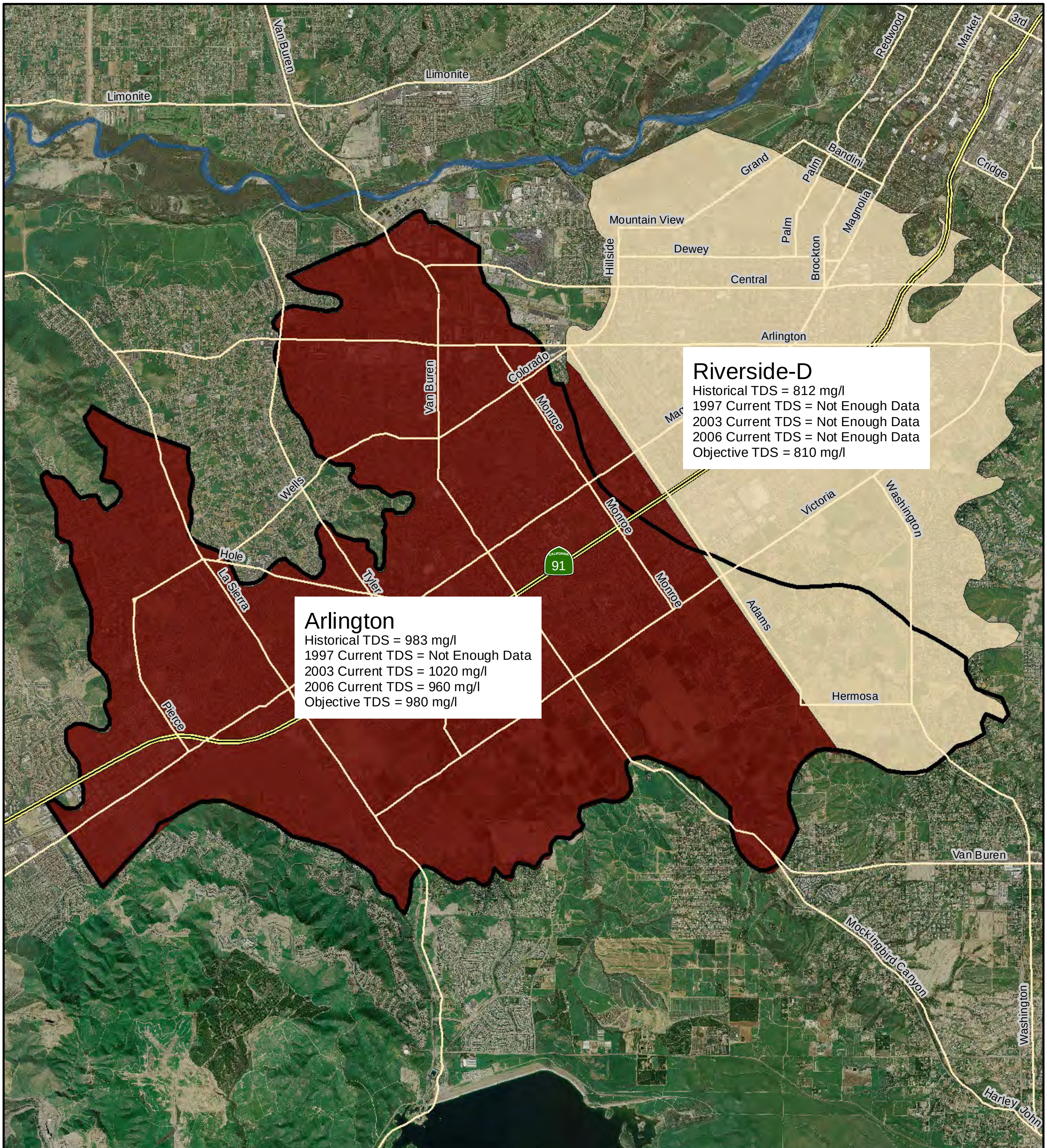
WESTERN MUNICIPAL WATER DISTRICT

Management Zone Water Quality Conditions - Nitrate as Nitrogen

Arlington Basin Groundwater Management Plan

2010

Figure 2.9a



Legend

Plan Area
Roads
Highway

2006 Current TDS

- Not Enough Data
- 0 - 100 mg/l
- 100 - 250 mg/l
- 250 - 500 mg/l
- 500 - 750 mg/l
- 750 - 1000 mg/l
- >1000 mg/l

Recommended SMCL = 500 mg/l
Maximum SMCL = 1,000 mg/l

* Water Quality Data Source:
Wildermuth 2000, 2005, 2008b

0 0.5 1 2 Miles

N S E W

WESTERN MUNICIPAL WATER DISTRICT

Management Zone Water Quality Conditions - Total Dissolved Solids

Arlington Basin Groundwater Management Plan

2010

Figure 2.9b

In the Arlington Management Zone, TDS exceeds the Basin Plan Objective of 980 mg/L and the recommended secondary MCL (SMCL) of 500 mg/L for the Historical and 2006 Current time periods. The TDS levels in the Arlington Management Zone exceeded the Basin Plan Objective and the upper SMCL (1,000 mg/L) for the 2003 Current time period. Sufficient Arlington Management Zone TDS data are not available for the 1997 Current time period. TDS exceeds the Basin Plan Objective of 810 mg/L and the recommended SMCL of 500 mg/L in Riverside D for the Historical time period. Sufficient Riverside D Management Zone TDS data are not available for the other time periods.

Table 2.3
Historical (1954-1973), 1997 Current (1978-1997), 2003 Current (1984-2003), and 2006 Current (1987-2006) Ambient Nitrate as N and TDS Concentrations (mg/L)

Management Zone	Nitrate as N [1]					TDS[2]				
	Basin Plan Objective[3]	Historical	1997 Current	2003 Current	2006 Current	Basin Plan Objective[4]	Historical	1997 Current	2003 Current	2006 Current
Arlington	10.0	**25.5**	**?**	**26.0**	**20.4**	980	**983**	**?**	**1020**	**960**
Riverside D	10.0	**19.5**	**?**	**?**	**?**	810	**812**	**?**	**?**	**?**

? = Not enough data to estimate concentrations; Management Zone is presumed to have no assimilative capacity.
Source:
[1]Wildermuth, 2008b. (Table 3-2)
[2]Wildermuth, 2008b. (Table 3-1)
[3]RWQCB, 2004 (Table 5-4)
[4]RWQCB, 2004 (Table 5-3)

The RWQCB used these point statistics and water quality objectives to develop estimates of assimilative capacity. Management zones with assimilative capacity are able to accept waters with constituent concentrations higher than those in the receiving waters because natural processes such as recharge and dilution allow the water quality objectives to continue to be met. The most recent computations indicate that neither Arlington nor Riverside D have assimilative capacity for TDS or nitrate (Wildermuth, 2008b).

Table 2.4 shows the change in the point statistics in Arlington seen over the 30-year time period between the historical and 2006 Current time periods. Sufficient data are not available for Riverside D; Arlington shows fluctuations, but continued high levels of Nitrate as N and TDS. It should be noted that changes between these time periods are a combination of true changes in ambient water quality and artificial changes due to limitations in monitoring data and the estimation technique (Wildermuth, 2005). In the future, as monitoring programs assemble more data, a long-term record of analytical data at specific wells will better show changes over time at specific locations.

Table 2.4 Change in Ambient Concentration (mg/L) of Nitrate as N and TDS, Between Historical (1954-1973) and 2006 Current (1987-2006) Time Periods

Management Zone	Change in Nitrate as N (mg/L)	Change in TDS (mg/L)
Arlington	-5.1	-23
Riverside D	n/ a	n/ a

In addition to the ambient water quality concerns, contaminated groundwater from point sources can quickly remove wells from service and thus requires close coordination with regulatory agencies such as the United States Environmental Protection Agency (EPA) and the California Department of Toxic Substances Control (DTSC). Based on a search of DTSC's Envirostor database, there is one identified federal, state, military evaluation, or voluntary cleanup site with action required that is potentially affecting the aquifer system, Camp Anza. The RWQCB is the lead agency for the cleanup of Camp Anza (Envirostor ID: 33970009), which has the following potential contaminants of concern: explosives (UXO, MEC) and chlorine. A Preliminary Assessment / Site Inspection Report is due in 2010

As with all urban areas in the state, numerous Leaking Underground Fuel Tanks and Spills Leaks Investigation and Cleanup sites are in the Plan Area and are being monitored and/ or remediated under the regulatory lead of the RWQCB or the Riverside County Local Oversight Program. Leaking Underground Fuel Tanks are typically at gas stations, while Spills Leaks Investigation and Cleanup sites have a variety of sources, but all involve hazardous wastes that have negatively impacted soil and/ or groundwater.

2.3.7 DESALTER INFRASTRUCTURE

The existing Arlington Desalter facility, operating since 1990, extracts and treats impaired groundwater from the Plan Area in the southwestern area of the City of Riverside. The desalter facility uses reverse osmosis technology to produce up to 6 mgd of blended desalinized water, with more than 1 mgd of concentrated brine (high salinity water) generated by the plant and discharged to the Santa Ana Regional Interceptor (SARI) line, which is treated by Orange County Sanitation District and used for recharge by Orange County Water District (MWD, 2007). The desalter was managed and operated by SAWPA until the desalter assets and operations were transferred to Western in 2005. Water from the Arlington Desalter is supplied to the City of Norco to meet up to 60% of its municipal demand, as well as providing emergency supply for neighboring agencies. (Rossi, 2007; Santa Ana Watershed Project Authority [SAWPA], 2009).

The SARI line, a regional brine line designed to convey 30 mgd of non-reclaimable wastewater from the upper Santa Ana River basin to the ocean for disposal after treatment, has one branch serving the Plan Area (Reach IV-B, which serves the Arlington Desalter). The non-reclaimable wastewater consists of desalter concentrate and industrial wastewater. Proximity to the SARI line provides more options for future desalter projects.

2.3.8 GROUNDWATER/SURFACE WATER INTERACTION

As stated in Section 2.2, there are no major surface water bodies in the Plan Area. Smaller surface water bodies include several flood control basins operated by RCFCWCD. The basins capture a portion of storm runoff and allow for some of this water to percolate into the groundwater system. Additionally, the Arlington, La Sierra, and Arizona flood control channels are partially unlined, allowing for a portion of the water to seep into groundwater. The recharge from these individual sources has not been quantified.

Wildermuth (2008a) suggests that groundwater is discharged to surface water in three areas: Arizona Channel, Arlington Channel, and Hole Lake, based on persistent dry-weather flow and historical evidence of nuisance high groundwater levels in those areas.

2.3.9 SUBSIDENCE AND LIQUEFACTION

Subsidence and liquefaction are both influenced by groundwater levels and their interaction with the aquifer materials, such as sands, silts and clays. High groundwater levels can contribute to liquefaction potential, while changes in groundwater levels can contribute to subsidence.

Land subsidence here refers to the lowering of the Earth's surface as a result of groundwater level changes, not tectonic changes. Subsidence can occur from lowering and rising groundwater water levels.

Aquifers, particularly the fine-grained materials within or between the aquifers, are compressible. While most available water in aquifers is stored between larger grained soil particles, such as sands and gravels, smaller grained soil particles such as clays also hold water when saturated. If groundwater levels decrease as a result of pumping or other causes, water may be released from beds of clay or silt around the coarser materials that are the primary source of water in the aquifer. The release of water from the beds of clay and silt reduces the water pressure, resulting in a loss of support for the clay and silt beds. Unlike sands and other coarser materials, clays are compressible. Because these beds are compressible, they compact (become thinner), and the effects are seen as a lowering of the land surface (Leake, 2004). Whether subsidence through compression occurs in an area depends on groundwater levels (groundwater levels must decline) and on materials (sufficient compressible clays and silts must be present).

Subsidence can also occur from rising groundwater levels, resulting in collapsible soil hydrocompaction. Rapid collapse of up to 15% of the soil thickness can occur from a total loss of cohesion as soils saturate for the first time. Alluvial silts in semi-arid basins are most susceptible to hydrocompaction (Waltham, 2002). In Riverside County, soils most susceptible to hydrocompaction are present at the base of the mountains, where recent alluvial fan and wash sediments have been deposited during rapid runoff events. In addition, some windblown sands may be vulnerable to collapse and hydroconsolidation. Typically, differential settlement of structures may occur when lawns or plantings are heavily irrigated in close proximity to a structure's foundation (Riverside, County of, 2003).

Much of the basin is considered susceptible to subsidence (Riverside, County of, 2003), although no measurements of historical subsidence are available and no instances of damage in the Plan Area have been identified. Groundwater management within historical elevation ranges can minimize the potential impact of future subsidence.

The Plan Area also has potential for liquefaction, where earthquake-induced shaking can cause a loss of soil strength, resulting in the inability of soils to support structures. This can occur in saturated soils where shaking causes an increase in water pressure to the point where the soil particles can move easily within the soil-water matrix. Conditions in the Plan Area are most conducive to liquefaction southwest of Jackson Street and close to the hills surrounding the basin (Riverside, City of, 2007). High groundwater levels, along with appropriate soil conditions (sands or silts of uniform grain sizes), contribute to the risk of earthquake-induced liquefaction. No historical instances of liquefaction are known within the Plan Area. Limiting high groundwater levels can help reduce risks of liquefaction.

2.3.10 GROUNDWATER MONITORING

Groundwater monitoring activities in the Plan Area include monitoring groundwater levels, groundwater production, and groundwater quality. Due to the lack of historical instances of damage from subsidence, there is currently no active subsidence monitoring program.

2.3.10.1 Groundwater Level Monitoring

Groundwater level monitoring is an important component of the ongoing groundwater management in the Plan Area. Data are collected from wells in the basin and incorporated into regional groundwater level databases.

Groundwater level databases are maintained by SAWPA and Western. The two SAWPA databases described here recently were combined into one database with all data from the Basin Monitoring Program Task Force, including ambient water quality updates, Total Maximum Daily Load task forces, and groundwater well quality and levels. The details of these databases are as follows:

- Cooperative Well Measuring Program Database - Maintained by Western, this database includes data from 74 cooperating agencies and firms and their nearly 4,500 wells in the Upper Santa Ana, San Jacinto and Santa Margarita Watersheds. Groundwater level data in this database are available from 1993 to present and include fall and spring measurements. Data are available in various other formats under the Cooperative Well Measuring Program from 1964 to present.
- Santa Ana Basin Relational Information Network Application (SABRINA) database - Maintained by SAWPA, this database contains monitoring data for 10,000 wells in the Santa Ana River Watershed and surrounding areas. Groundwater level data are available from 1904 to 2003. The SABRINA database is used to share groundwater monitoring data between agencies for groundwater management and geographic information system analysis.
- Santa Ana Watershed Data Management System (SAWDMS) – Maintained by SAWPA, this database covers most of the Santa Ana River Watershed with groundwater level data available from the 1910 to present. The SAWDMS contains over 765,000 records related to approximately 6,600 wells in the Santa Ana Watershed and appurtenant groundwater basins. The SAWDMS is used primarily to reflect and store the triennial reports on water quality and water levels (Cozad, 1998; S. Mains, pers. comm., February 4, 2009; M. Norton, pers. comm, October 12, 2011).

2.3.10.2 Groundwater Production Monitoring

Groundwater production in the Plan Area is monitored through water recordation filings submitted to the California State Water Resources Control Board (SWRCB) as part of the Annual Notices of Groundwater Extraction and Diversion Program. Starting in 2005, the SWRCB transferred authority for this program to local agencies, including Valley District, San Gorgonio Pass Water Agency, and Western for the Plan Area and surrounding watersheds. Filings are made in compliance with Water Code Sections 4999 et seq., which requires filing, with few exceptions, by persons who extract more than 25 AF of groundwater from wells in Riverside, San Bernardino, Los Angeles, or Ventura Counties.

These filings are compiled into annual Water Extractions Reports by the local cooperating agencies: Valley District, San Gorgonio Pass Water Agency, and Western.

2.3.10.3 Groundwater Quality Monitoring

Groundwater quality is monitored to meet the California Department of Public Health's requirements specified in Title 22 of the California Code of Regulations. These requirements apply to active municipal productions wells.

A significant ambient groundwater quality reporting program for nitrate as N and TDS was developed and is maintained by SAWPA. The program compiles groundwater quality data and develops point statistics for the two defined Management Zones in the Plan Area (see Figure 1.7). The RWQCB's Basin Plan incorporates the ambient water quality monitoring program, with objectives defined for each Management Zone.

2.3.11 Subsidence Monitoring

Due to the lack of historical instances of damage from subsidence, there is no active subsidence monitoring program.

2.4 IMPORTED WATER

Imported water in the Plan Area, from the SWP and to a lesser degree the Colorado River Aqueduct, is supplied by Western. Western is a wholesale purchaser of imported water with contractual rights to imported water from Metropolitan, and provides this water to the other retail water suppliers. Corona utilizes imported water for approximately 44% of its total water supply (Western, 2008b). RPU purchases small quantities (40 AF in 2008, 0 AF in 2009) of treated imported surface water from Western to meet peak demand needs in the higher elevations of the RPU service area. RPU has a contractual agreement with Western for 30 cubic feet per second of imported water and takes deliveries through several service connections. RPU obtained a maximum of 5,493 AF of water through the Mills Connection (in 1990) and 4,986 AF of water through the Van Buren Highline (in 1999) (RPU, 2005). These values apply to the RPU service area as a whole, including the Arlington and Riverside Basins. Western uses imported water to meet the demands for its retail customers in the Plan Area, as well as retail and wholesale demands outside the basin. Imported water is treated at the Mills Filtration Plant and is also delivered untreated to the retail agencies.

Metropolitan uses ozone, a state-of-the-art water treatment technology, as the primary disinfectant in its Mills Treatment Plant. The water is also disinfected with chloramines. Chloramines, a combination of chlorine and ammonia, prevent re-growth of potentially harmful bacteria in the water distribution system. The water, sourced from the SWP, is high quality, meeting or exceeding all state and federal standard and with an average TDS of 291 parts per million (ppm) and average nitrate of 0.7 ppm (Metropolitan, 2008). Consumer Confidence Reports are included in Appendix C.

2.5 RECYCLED WATER

Wastewater collection in the Plan Area is performed by the City of Riverside, Corona, Home Gardens Sanitary District, and the Western Riverside County Regional Wastewater Authority (WRCRWA).

The Riverside Public Works Department operates a comprehensive wastewater collection, treatment, and disposal system that serves most of the City of Riverside, as well as portions of the sphere of influence area and, under contract, the unincorporated communities served by the Jurupa, Rubidoux, and Edgemont Community Services Districts. The Riverside Public Works Department also serves the unincorporated community of Highgrove through an agreement with Riverside County. Western is responsible for collection and treatment of wastewater flows only in a small portion of the City of Riverside. Historically, the Riverside Public Works Department and Western have cooperatively determined which agency can best serve an area with water and wastewater services. This arrangement has led to a mixing and matching of service providers. The city's wastewater collection system includes over 102.7 miles of gravity sewers and 18 wastewater pump stations and serves 280,000 residents of Riverside and other communities (Riverside, 2007).

Corona operates four wastewater treatment plants with a combined existing capacity of 15.5 mgd and an ultimate capacity of 20.5 mgd. Sewer service is provided to 33,967 connections within 22,144 acres that include Corona and the unincorporated El Cerrito area. Existing flows average approximately 10.5 mgd (Riverside Local Agency Formation Commission [LAFCO], 2005). Corona's primary wastewater treatment plant, the Corona Water Reclamation Plant, is located near the Santa Ana River along Railroad Street, a significant distance from the Plan Area.

Home Gardens Sanitary District provides wastewater collection and treatment within a 672-acre service area with 2,438 wastewater service connections. The sewer collection system is entirely gravity flow and the District owns one wastewater treatment plant, which is operated by the WRCRWA (Riverside LAFCO, 2005).

Western is a member agency of the WRCRWA and the contract operator of the Western Riverside County Regional Wastewater Treatment Plant (WRCRWTP), an 8 mgd plant capable of producing tertiary treated recycled water. WRCRWA is a public agency created to plan, construct, and operate a cost effective regional wastewater reclamation treatment and collection system. Wastewater from Western's retail and wholesale customers, the City of Norco, Jurupa Community Services District, and Home Gardens Sanitary District are treated at WRCRWA's wastewater plant (Western, 2009a).

2.5.1 TREATMENT PLANTS

Wastewater in the Plan Area is treated by the Riverside Regional Water Quality Treatment Plant (RWQTP) and the WRCRWTP.

2.5.1.1 Riverside Regional Water Quality Treatment Plant

The Riverside (RWQTP) at 5950 Acorn Street in Riverside provides tertiary treatment for sanitary sewer service for 280,000 residents in the City of Riverside and Jurupa, Edgemont, and Rubidoux communities. It consists of two secondary treatment plants, one tertiary treatment plant, and sludge handling facilities. Approximately 50 acres of wetlands were previously used for additional treatment at Hidden Valley Wetlands. The effluent from the plant is largely discharged to the Santa Ana River, with a limited volume reclaimed for beneficial use. The effluent released to the Santa Ana River is available for groundwater recharge below Prado Dam. Effluent discharged into Reach 3 of the Santa Ana River from the RWQTP in water year

2008-2009 was 33,636 AF (Santa Ana River Watermaster, 2010). According to the Santa Ana River Judgment, base flow in the Santa Ana River must be maintained at 15,250 AFY at Riverside Narrows and 42,000 AFY at Prado Dam (with adjustments based on quality) to meet commitments (*Orange County Water District vs. City of Chino et al.,* 1969). The tertiary treatment provides high-quality, dechlorinated water for these uses. In 2008, the plant had a capacity of 40 mgd, an average daily flow of 32 mgd, and an average peak flow of 36 mgd. Capacity is not anticipated to be reached before 2025. A planned expansion will allow the facility ultimately to treat 52.2 mgd of wastewater (Jones & Stokes, 2006; Riverside, City of, 2007).

2.5.1.2 Western Riverside County Regional Wastewater Treatment Plant

The WRCRWTP is located at 14634 River Road in Corona. The plant is operated by Western for the WRCRWA, which includes member agencies City of Norco, Home Gardens Sanitary District, Western Municipal Water District, Jurupa Community Services District, and the Santa Ana Watershed Project Authority. It is a tertiary facility capable of providing water for reuse or for discharge through an outfall to the Santa Ana River. The plant was brought online in 1998 and has a design capacity for 8 mgd with the capability for expansion to 32 mgd. This facility performs high levels of treatment through a number of consecutive wastewater treatment processes. Wastewater from a portion of Western's customers, the City of Norco, Jurupa Community Services District, and Home Gardens Sanitary District, is collected through many miles of pipelines, pumped to the treatment plant, processed and discharged into the Santa Ana River (Western, 2009a). Effluent discharged to the Santa Ana River from the WRCRWA plant in water year 2008-2009 was 6,374 AF (Santa Ana River Watermaster, 2010).

The plant currently operates with a live stream discharge to Reach 3 of the Santa Ana River, but with a recycled water distribution system it can provide recycled water to the City of Norco and to the Jurupa Community Services District service area. The WRCRWA is in the early planning stages of an expansion project to 11-14 mgd capacity and in the final planning stages of providing recycled water to the City of Norco, however, distribution infrastructure is required in the City (SAWPA, 2009).

2.5.2 RECYCLED WATER INFRASTRUCTURE AND USERS

The City of Riverside operates a small recycled water system composed of 8-inch and 12-inch diameter distribution mains, including recycled water pipelines under Van Buren Boulevard and Doolittle Avenue. Riverside supplies approximately 290 AFY of recycled water near the boundary with the Riverside Basin in the northern part of the Plan Area. Customers include the Van Buren Golf Center, Van Buren Urban Forest, and Toro Manufacturing Company (Jones & Stokes, 2006). Corona also operates a recycled water system, but the customers are all outside of the Plan Area.

2.5.3 RECYCLED WATER QUANTITY AND QUALITY

Currently, the Riverside RWQTP operates under the NPDES permit designated as Order No. 1-3, NPDES No. CA0105350 with Adoption Order No. R8-2006-0009. This permit includes requirements that implement the Santa Ana River Basin Plan. Effluent quality standards require tertiary treatment with filters and disinfection equivalent to Title 22 requirements for recycled water because of use of receiving waters for water contact recreation. The Riverside RWQTP produces effluent that consistently conforms to the Title 22 requirements. Data from 2001 showed average effluent TDS of 520 mg/L. The 36,000 AFY of effluent from the plant far exceeds existing recycled water distribution capacity (Parsons, 2003; Jones & Stokes, 2006).

Currently, effluent from the WRCRWA plant is not recycled for direct reuse. However, usage of recycled water from the plant is anticipated in the future, with projections showing 6,000 AFY of recycled water use by 2030 (Western, 2008b).

The quality of recycled water for future recycled water users will meet regulatory guidelines and will also meet the unique needs of specific users through blending or treatment techniques.

Discharge of treated effluent into the Santa Ana River is an important component of meeting the annual delivery of base flow as mandated in the Santa Ana River Judgment: 42,000 AFY at Prado Dam and 15,250 AFY at Riverside Narrows. Discharge from the RWQTP and WRCRWA are both downstream of Riverside Narrows and upstream of Prado Dam. The Santa Ana River Judgment is a physical solution adopted by the Court to resolve claims of inter-basin allocation of obligations and rights in the Santa Ana Watershed.

3 WATER REQUIREMENTS AND SUPPLIES

An understanding of the historical, current, and projected water requirements and supplies is important for ongoing groundwater management. By determining how water purveyors and private users meet their demands and how those supplies and demands are projected to change, potential stresses on the groundwater basin can be recognized and potential opportunities for improved management of the groundwater resource can be realized.

3.1 CURRENT AND HISTORICAL WATER REQUIREMENTS AND SUPPLIES

Water supplies in the Plan Area have shifted over the latter half of the 20th century from meeting a largely agricultural demand to meeting a largely urban demand. Citrus acreage in the Riverside area reached its largest extent in the early 1940s at 12,000 acres and has declined dramatically since that time. Today, approximately 2,200 acres of citrus remain within the boundaries of the City of Riverside, largely within the Arlington Heights greenbelt. Riverside's population grew as the citrus acreage increased from the late 1800s through the 1940s. However, the population increased even more rapidly after World War II as urbanization replaced citrus acreage with homes and businesses (Salazar, 1997). The City of Riverside's population increased from 3,000 in 1883 (Holmes, 1912), 13 years after the settlement's founding, to approximately 293,761 residents today (United States Census Bureau, 2009). Areas surrounding the City of Riverside have seen similar conversions from agriculture to urban uses. Water suppliers have shifted from providing primarily agricultural water to primarily urban water, while continuing to utilize the existing assets such as wells and conveyance systems and continuing to support local agricultural interests. Private groundwater pumpers use groundwater from the Plan Area to meet all or a portion of their demands, and Western uses Plan Area groundwater to meet wholesale demands outside the Plan Area.

Groundwater production in other basins and other water supply sources are also used to meet demands in the Plan Area. The agencies that supply water to the Plan Area also have groundwater production wells within the Bedford, Bunker Hill, Coldwater, Rialto-Colton, Riverside, and Temescal Basins. Similarly, some groundwater pumped in the basin is served outside the basin, specifically Norco's usage of water from the Arlington Desalter. Imported water and recycled water complete the historical supply mix. Wholesale imported water for agency use is provided by Western. Table 3.1 summarizes the water supply sources for entities based on 2009 data. This table includes private producers, Western's Arlington Desalter, as well as RPU, the only other water purveyor with a significant portion of its service area within the Plan Area. Approximately 27% of RPU's service area is within the Arlington Basin.

Table 3.1 includes the full water supply for RPU, although its service area extends beyond the Plan Area boundaries. Agencies without a significant portion of their service areas in the Plan Area are not included:

- Western North and South Service Area (1% within the Plan Area)
- Corona (1% within the Plan Area)

Details for each agency are provided by agency in Section 3.1.3.

Table 3.1 Summary of Current Water Supply Sources for Entities Overlying the Plan Area

Agency	Supply (AFY)				
	Plan Area Groundwater	Other Groundwater	Imported Water	Recycled Water	Total
RPU	0	84,750	0	137	**84,890**
Western - Arlington Desalter	6,935	0	0	0	**6,935**
Private Producers	1,668	0	0	0	**1,668**
Total	**8,603**	**84,750**	**0**	**137**	**93,493**

Valley District and Western, 2010.

Water demand in the Plan Area is higher in the summer months than in the winter months, primarily due to the climatic conditions discussed in Section 2.1. The current water supply facilities are capable of meeting demands throughout the year, including extremely hot, dry days with very high water use. The typical monthly water demand distribution is shown on Figure 3.1.

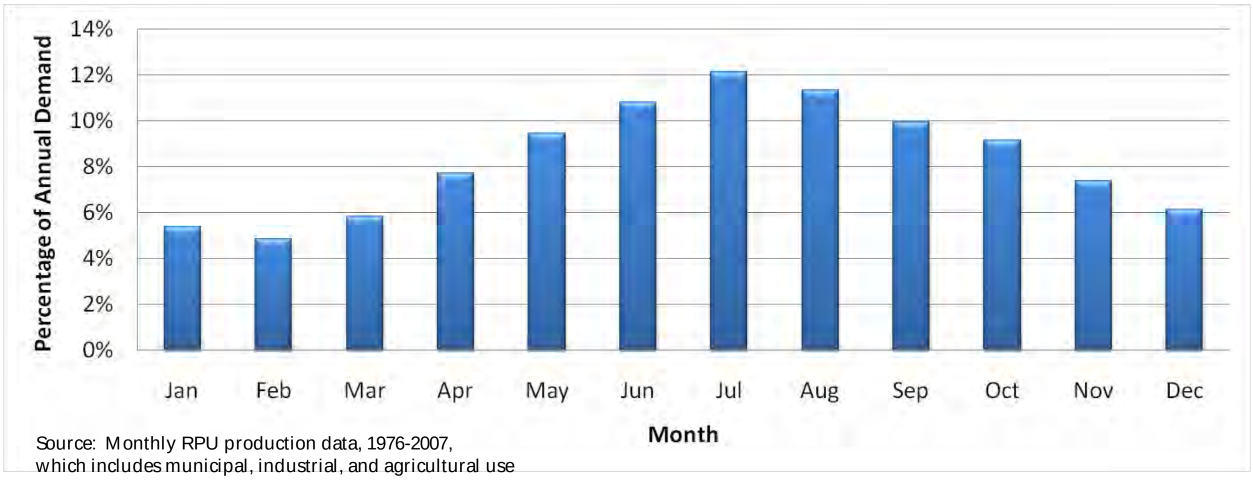


Figure 3.1 Average Monthly Distribution of Annual Demand

Details on water use by agency are presented in the following sections. Data are available from the individual agency Urban Water Management Plans, directly from agency staff, from the Western IRWMP, and from historical groundwater production records from the database used to develop Water Extraction Reports by Valley District and Western. These available data sources were used to summarize the supply sources, quantify the current supply mix, and quantify historical groundwater production. Historical conditions are represented by Plan Area groundwater production data from the Water Extraction Report database for 1965 – 2009. Current conditions are represented by 2009 data, where available, from the Water Extraction Report database for Plan Area groundwater and through personal communication with the water agencies for remaining supply sources, such as imported water, recycled water, and groundwater from outside the Plan Area. Where data were not available for 2008 or 2009, information from the 2008 IRWMP was utilized.

3.1.1 SUPPLY MIX

Details on water demand and supply by the water agencies and private groundwater producers are presented in the following sections.

3.1.1.1 Riverside Public Utilities

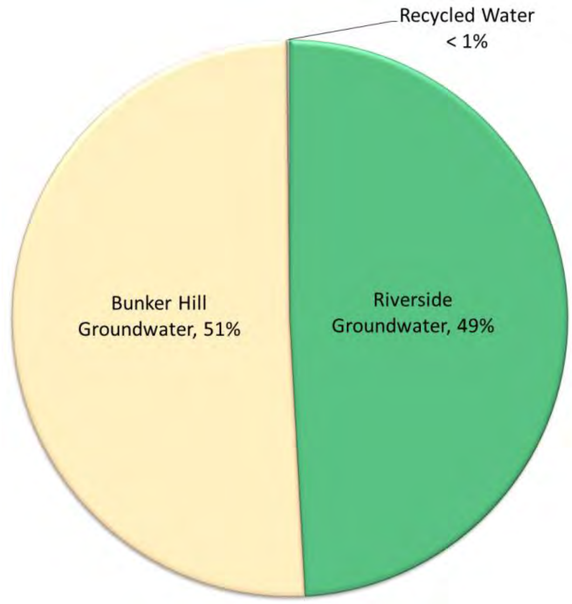


Figure 3.2 Current Water Supply Sources, RPU

Riverside Public Utilities (RPU) provides water to 64,000 services (298,000 customers) within a service area of 74 mi^2 (Figure 1.3), of which approximately 5 mi^2 are outside the Riverside city limits.

Riverside's water supply is nearly entirely groundwater, produced from the Bunker Hill Basin in San Bernardino County and the Riverside Basin in San Bernardino and Riverside Counties, with minor production in the Colton Basin. The remainder is imported water from Western and recycled water.

Riverside Public Utilities' current strategy for groundwater production is to fully utilize the 53,426 AFY entitlement (including entitlements through share ownership in mutual water companies) to export water from the Bunker Hill Basin (RPU, pers. comm., December 3, 2009) and extract approximately 40,000 AFY from the Riverside Basin to meet remaining demands. Efforts to meet this strategy results in a current supply mix that is 51% groundwater from Bunker Hill Basin and 49% groundwater from Riverside Basin. Recycled water continues to be a small component of the current water supply, less than 1%.

RPU has not produced groundwater from the Plan Area since 1996. 2009 supply sources are shown on Figure 3.2 and include groundwater from the Riverside and Bunker Hill Basins as well as imported and recycled water.

Historical groundwater production from the Plan Area is discussed in Section 3.2.2.

3.1.1.2 Western Municipal Water District

Western was formed by the voters in 1954 to bring supplemental water to growing western Riverside County. Today, Western serves more than 25,000 retail customers in Riverside and Murrieta and nine wholesale customers with water from both the Colorado River and the SWP as a Metropolitan member agency. Approximately one-quarter of the water Western purchases from Metropolitan comes from the Colorado River Aqueduct and about three-quarters from the SWP, which transports water from Northern California via the California Aqueduct (Western, 2008b). Western also imports a small quantity of non-potable groundwater from the Riverside/ San Bernardino area through a contract between Western and Elsinore Valley Water District. Western's only groundwater production is from the Arlington Desalter wells in the Plan Area.

Supplemental water also comes from the City of Riverside through the Mockingbird connection, when water is available.

Western is one of five member agencies in SAWPA, a regional water resources planning and project implementation organization. Western's general manager is a court-appointed Watermaster, responsible for reporting compliance with water quality and quantity provisions of court orders regarding water rights issues in the Santa Ana Watershed.

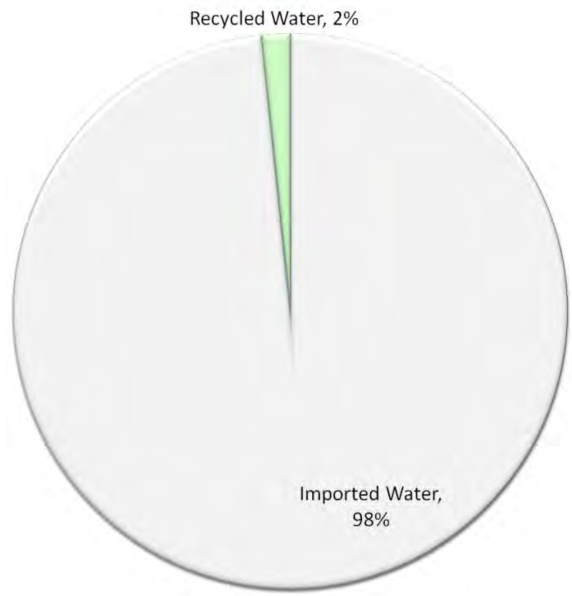


Figure 3.3 Current Water Supply Sources, Western –North and South Retail Area

Western's general district includes 510 mi^2 in western Riverside County and a population of more than 850,000 people. Western currently sells over 100,000 AF of water annually. Improvement districts, the retail portion of Western's general district, cover approximately 73 mi^2 and Western's retail service provides water to an estimated population of approximately 80,000, based on 3.2 persons per household for about 25,000 residential domestic services (Western, 2008b).

One improvement district, the North and South Retail Area, serves a small portion of the Plan Area. However, only about 1% of the service area of the North and South Retail area is within the Plan Area, with the remainder of the service area to the south and east of the Plan Area. In 2009, the North and South Retail Area received approximately 30,700 AF of imported water and 800 AF of recycled water. The recycled water use was entirely outside of the Arlington Basin. (Western, pers. comm., February 7, 2011)

Current supply mix data are presented on Figure 3.3 for the full service area of the North and South Retail Area, based on the 2009 supply mix.

3.1.1.3 City of Corona

Corona serves approximately 150,000 customers in a 45-mi^2 service area both inside the city limits and in parts of unincorporated Riverside County (Western, 2008b). Only 1% of Corona's service area and city limits overly the Plan Area (Figures 1.2 and 1.3). Corona does not currently produce groundwater from the Plan Area, nor has it historically.

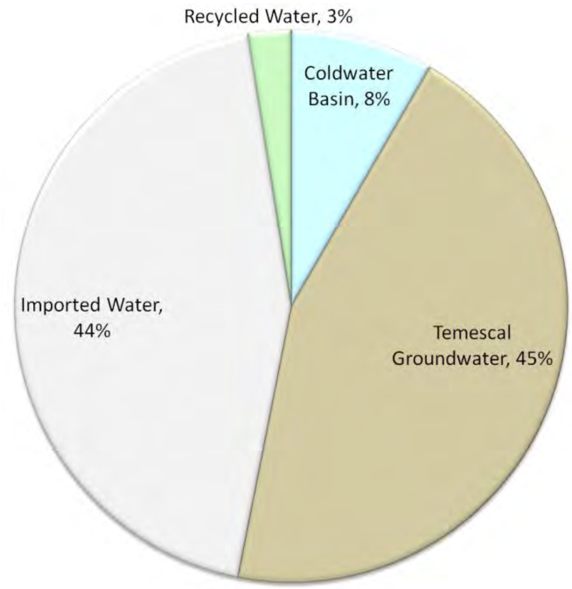


Figure 3.4 Current Water Supply Sources, Corona

Corona currently operates and maintains 21 active potable groundwater production wells, three water treatment plants receiving Colorado River water, and a connection to the SWP on the Mills (Woodcrest) Pipeline from Metropolitan's Mills Water Treatment Plant. Imported water from Metropolitan is delivered to Corona via three Western service connections on Metropolitan's Lower Feeder, which transverses Corona on an east-west alignment along Chase Drive and south of Green River Drive and its western projection. The untreated Colorado River water is distributed to Corona's Lester Water Treatment Plant, Sierra del Oro Water Treatment Plant, and Green River Water Treatment Plant (Western, 2008b). The Green River Water Treatment Plant was deactivated in 1996 and is now used only for emergencies (Corona, 2004).

In 2006, Corona began serving recycled water to its customers and currently has 57 connections using, on average, 1.4 mgd (Western, 2008b). Corona's infrastructure for the recycled water program consists of approximately 27 miles of pipeline, three storage reservoirs, and three pump stations. The recycled water system will produce approximately 6 mgd of recycled water. This water will then be used for the irrigation of golf courses, local parks, landscape maintenance districts, schools, and freeway landscaping (Western, 2008b).

As shown on Figure 3.4, groundwater accounts for 53% of Corona's water supply: 45% from Temescal Basin (immediately to the southwest of Plan Area) and 8% from Coldwater Basin (not adjacent to the Plan Area) (Western, 2008b). Corona's groundwater activities are managed through the AB3030 GWMP completed in June 2008 (Corona, 2008), which has goals of operating the groundwater basin in a sustainable manner for future beneficial uses and increasing the reliability of the water supply for basin users.

3.1.2 PRIVATE GROUNDWATER PRODUCERS

Private groundwater producers in the Plan Area pump groundwater for agricultural uses, irrigation for landscaping, irrigation for athletic fields, and other uses. These users currently use groundwater to meet all or a portion of their demand. Other supply sources are included in the data from the agency providing water to the customer.

3.1.3 TOTAL PLAN AREA WATER SUPPLY

Current and historical water demands in the Plan Area have been met through a combination of supplies, including groundwater pumping within the Plan Area, groundwater pumping outside the Plan Area (Bunker Hill, Riverside, and Temescal Basins), imported water, recycled water, and others. Figure 3.5 shows the current water supply mix for the Plan Area, summarized from the previous sections for private producers and RPU, the only retail agency with a significant portion of their service areas within the Plan Area. Values shown in Figure 3.5 represent 2009 data.

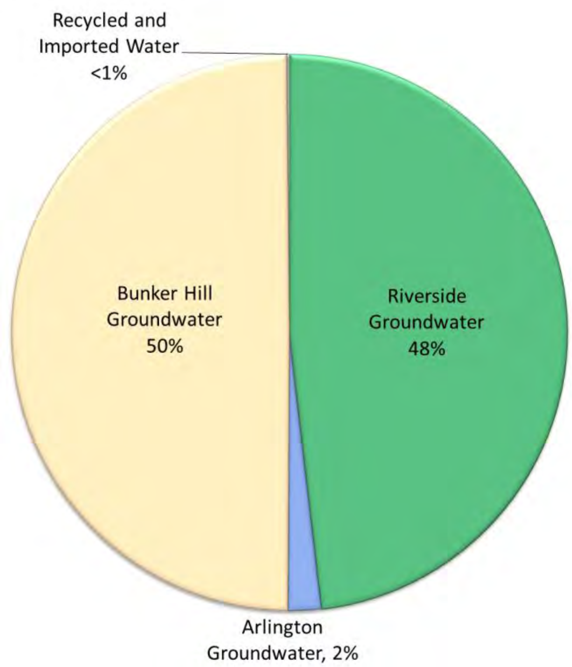


Figure 3.5 Current Water Supply Sources, Plan Area

3.2 GROUNDWATER PRODUCTION WITHIN THE PLAN AREA

Groundwater is produced in the Plan Area for use within and outside of the basin. Groundwater is produced for use within the basin by private producers (currently Bureau of Indian Affairs, La Sierra University, Loving Homes Greens Homeowners Association, and the Riverside Master Homeowners Association) and, historically, by RPU. Western's Arlington Desalter produces groundwater for delivery outside the Plan Area, currently to the City of Norco.

3.2.1 PRIVATE GROUNDWATER PRODUCERS

Private groundwater producers in the Plan Area pump groundwater for agricultural uses, irrigation for landscaping, irrigation for athletic fields, and other uses.

Historical use of Plan Area groundwater by private groundwater producers has averaged 2,300 AFY from 1965 to 2009, with relatively higher production prior to 1976, as shown on Figure 3.6 (Valley District and Western, 2010). Production from 1965 to 1969 also includes an average of 684 AFY of production by Riverside County. The data, shown in Figure 3.6, include the following current and/ or historical users, which represent all known major private producers at the time of publication:

Arlington Mutual Water Company	La Sierra University
Cardey, Max L.	Lease Associated-Courtesy Escrow
City National Bank Trustee	Lordon Management
Dept. of Interior, Bureau of Indian Affairs	Loving Homes Greens Homeowners
Firestone Syndicate	Reynolds, Harry C.
Gem's Cabinet Shop	Sweaney Group Arlington Heights Citrus
Hamner, J.A.	Teunissen, Fred J.
Koning, Walt & Cory	Watje, Theodore
Kartz, John D.	

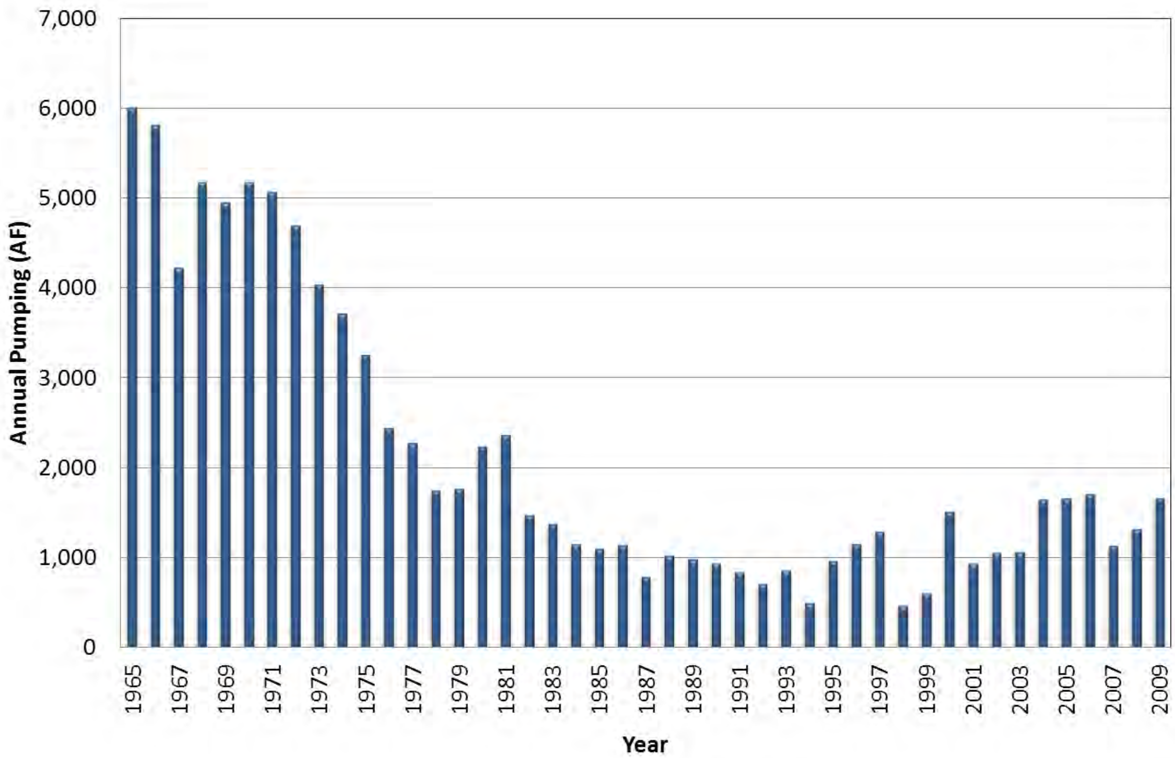


Figure 3.6 Historical Annual Plan Area Groundwater Production by Private Producers

3.2.2 RIVERSIDE PUBLIC UTILITIES

Riverside Public Utilities has not produced groundwater from the Plan Area since 1996. In and before 1996, RPU produced, on average, 1,545 AFY from the Plan Area, with higher production levels from 1965 to 1973 (4,384 AFY) than from 1974 to 1996 (434 AFY). Annual production from the Plan Area is shown on Figure 3.7, based on production records from the Water Extractions Reports (Valley District and Western, 2010).

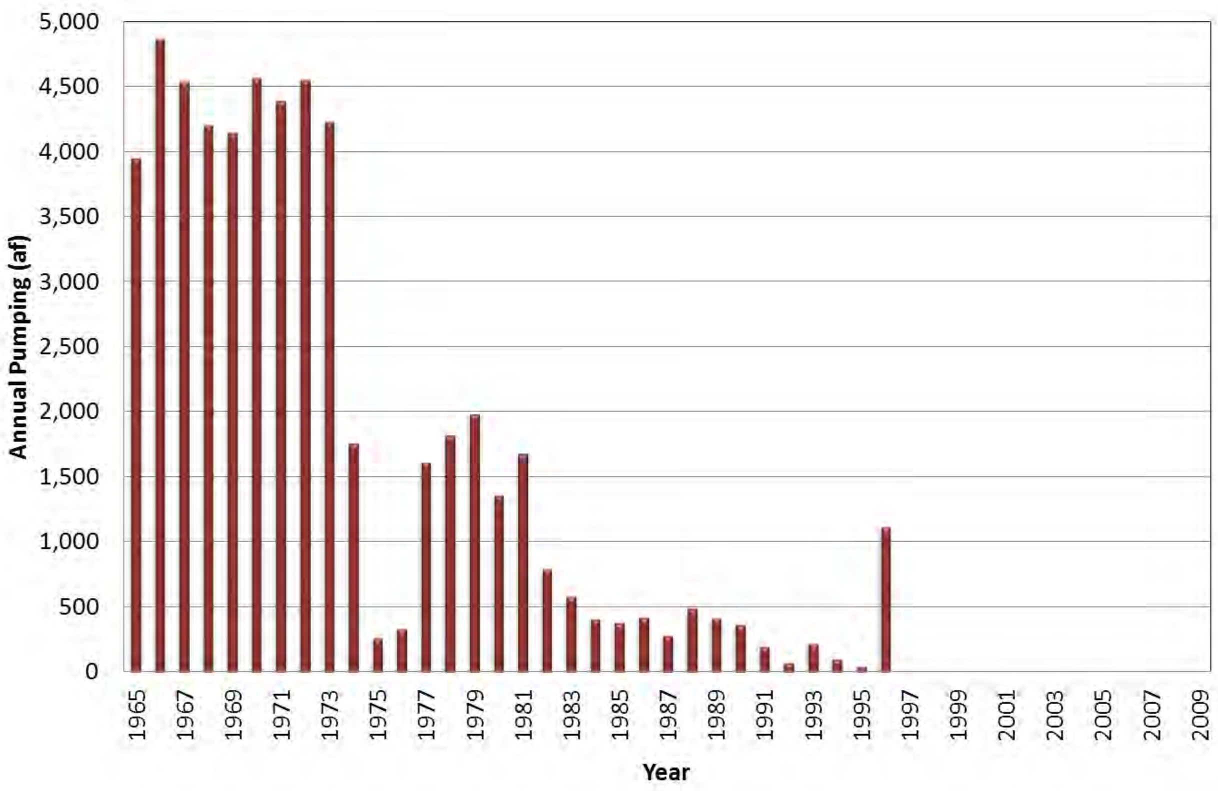


Figure 3.7 Historical Annual Groundwater Production from the Plan Area by Riverside Public Utilities

3.2.3 WESTERN MUNICIPAL WATER DISTRICT

Western is the sole water agency currently producing groundwater from the Plan Area; other producers are all private entities. Western's Arlington Desalter currently has five wells and a planned expansion may add additional production wells (Wildermuth, 2008a). The Desalter supplies water to Norco and can be an emergency supply for Western's North and South Retail Area (Western, 2005). In 2009, the Arlington Desalter produced 5,593 AF of water from 6,935 AF of pumped groundwater, with 1,100 AF of salt concentrate discharged into the Santa Ana Regional Interceptor for disposal. In 2010, the Desalter produced 4,597 AF of water from 6,030 AF of pumped groundwater, with 1,004 AF of salt concentrate discharged. (Western, pers. comm., February 7, 2011). Historical groundwater production for Western's Arlington Desalter, shown on Figure 3.8, began in 1990 and has averaged 5,700 AFY (Valley District and Western, 2010). Western purchased the desalter from SAWPA in 2005.

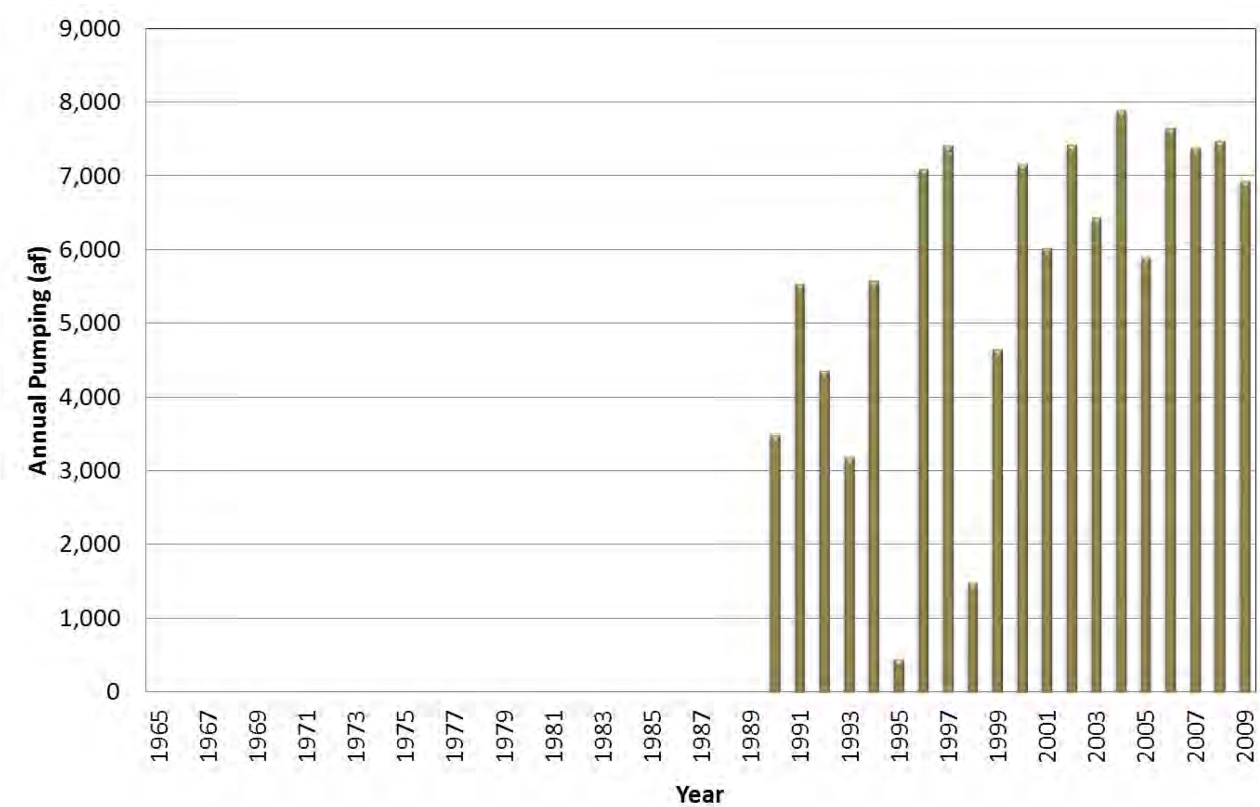


Figure 3.8 Historical Annual Plan Area Groundwater Production, Arlington Desalter

3.2.4 TOTAL PLAN AREA GROUNDWATER PRODUCTION

Plan Area groundwater provides an important source of water for private groundwater producers, as well as a source of water for Western's Arlington Desalter.

Figure 3.9 shows total annual groundwater production in the Plan Area by major producer. Figure 3.10 shows the distribution of recent (average of 2005 through 2009) groundwater production throughout the basin. In 2009, total groundwater production from the Plan Area was 8,603 AF (Valley District and Western, 2010).

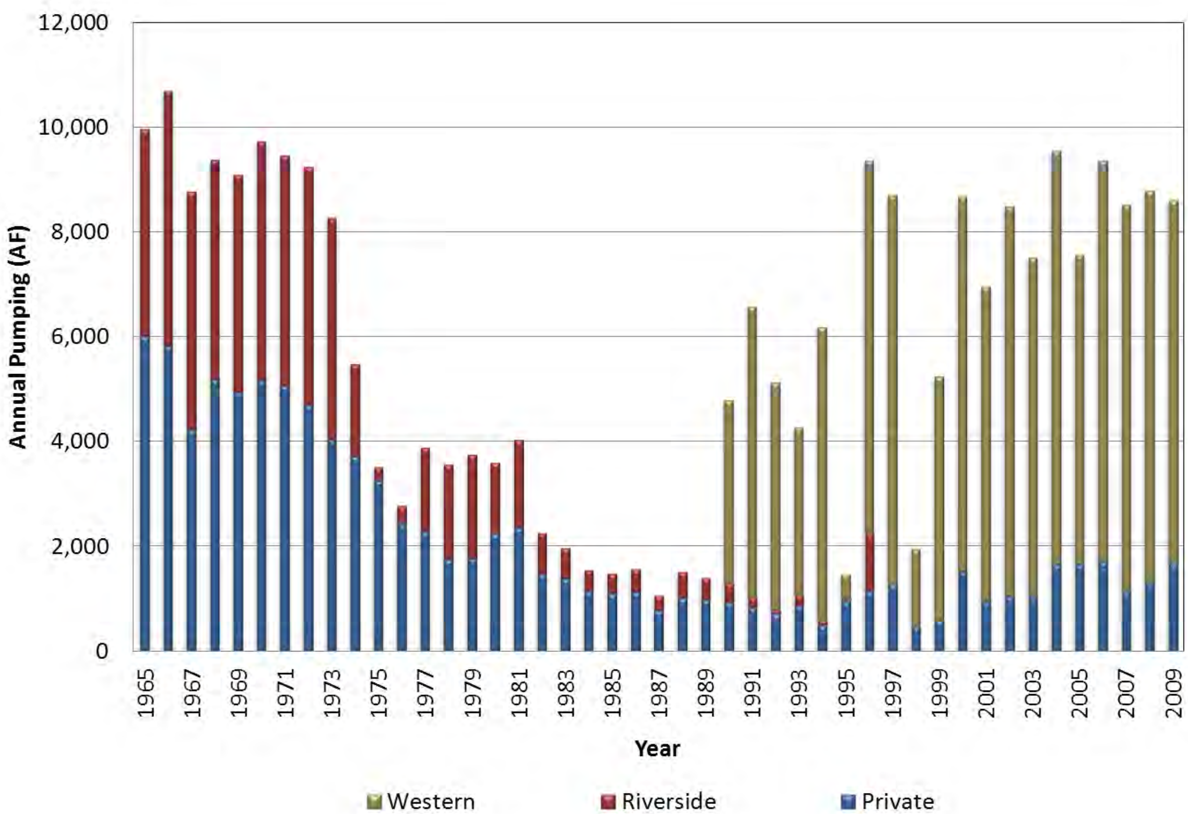
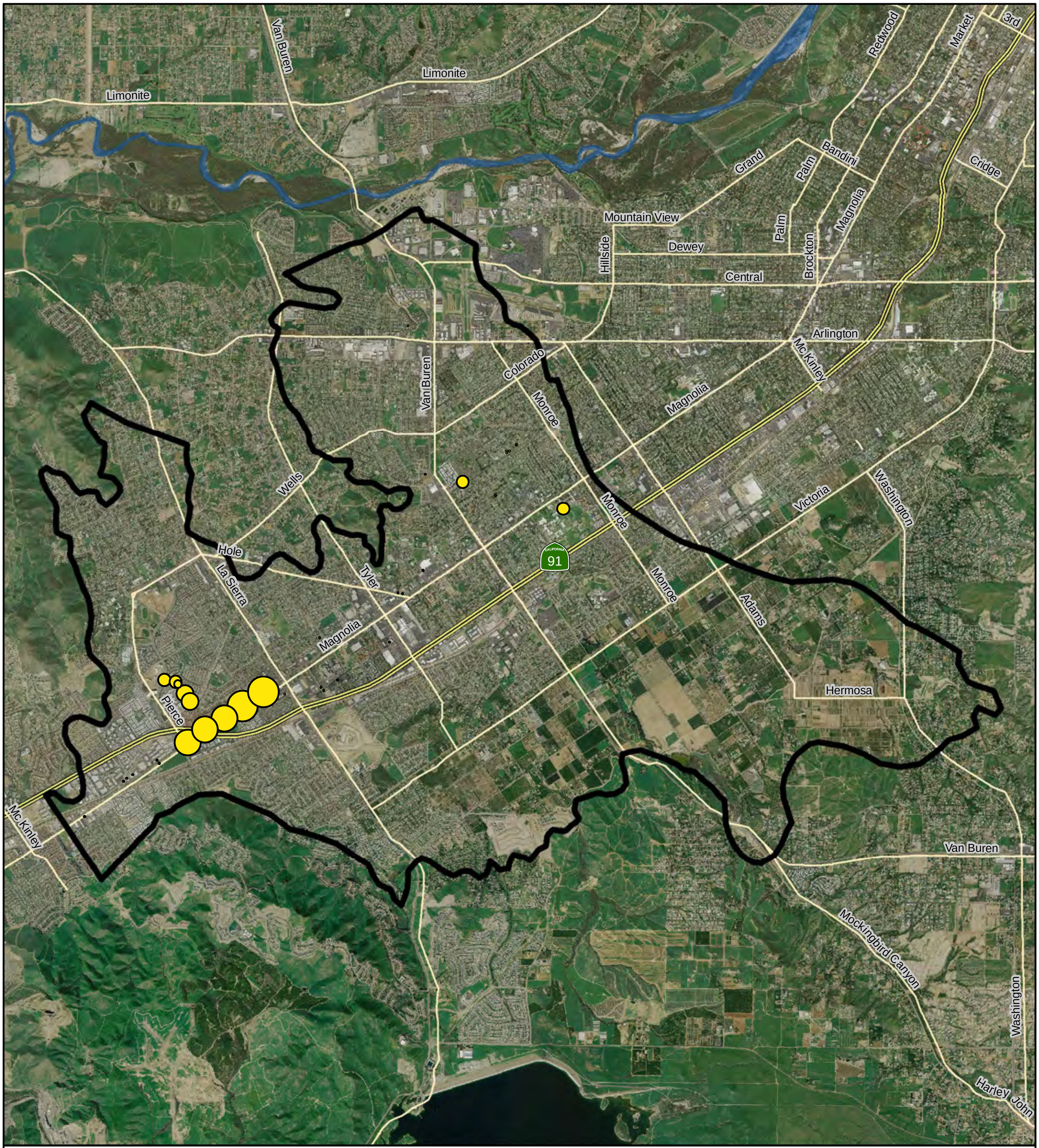


Figure 3.9 Historical Annual Plan Area Groundwater Production by Agency



Legend

Plan Area
Highway
Roads

Groundwater Production (afy)*
1 - 100
101 - 250
251 - 500
501 - 1000
1001 - 1500
> 1500

* Groundwater Production Data Source: Western-San Bernardino Watermaster, 2010

Some locations approximate

N W E S

0 0.5 1 2 Miles

WESTERN MUNICIPAL WATER DISTRICT

Groundwater Production, Average for 2005 to 2009

Arlington Basin Groundwater Management Plan

2010

Figure 3.10

3.3 PROJECTED WATER REQUIREMENTS AND SUPPLIES

As discussed in Section 3.2, the primary users of Plan Area groundwater are private groundwater producers and Western through its Arlington Desalter. Corona does not anticipate producing groundwater from the Plan Area within their planning horizon (Todd Engineers, 2008).

No estimates of future groundwater production by private groundwater producers are available; however, historical trends seen on Figure 3.6 suggest that the current volumes of groundwater production are likely to continue at a similar level into the future.

Western is in the planning phases for an expansion of the Arlington Desalter by increasing the treatment capacity from 6.3 mgd up to 10 mgd. This would allow the Arlington Desalter to supply more water for Western's service area. The project will likely be combined with artificial recharge of recycled and/ or storm water through ongoing cooperation with the RCFCWCD.

Figure 3.11 illustrates total water currently served (within and outside the Plan Area) as well as projections to 2030 by the primary retail water agency in the Plan Area, RPU. Private groundwater pumpers are also included with the assumption of a continuation of recent (2005 through 2009) levels of production. The water served by the retail water agencies includes groundwater from other basins as well as imported water and recycled water for users both within and outside of the Plan Area. For instance, while 2009 supplies for RPU were approximately 85,000 AF (as shown on Figure 3.11) only approximately one quarter of this amount was used within the Arlington Basin (RPU, pers. comm., December 3, 2009) and none of this water was produced from the Arlington Basin. It is important to look at the total supply for the agency rather than only the portion within the Plan Area. The Plan Area functions within a regional context where growth outside of the basin impacts the total water demand and changes in supplies outside the basin impact water availability in the basin; both changes in demand and changes in supply impact the demands placed on Plan Area groundwater. These changes in supplies and demands are best analyzed at the agency level, as the agencies provide a blended water supply throughout their service area.

Tables 3.2a and 3.2b present the projected Plan Area groundwater production and groundwater recharge, respectively.

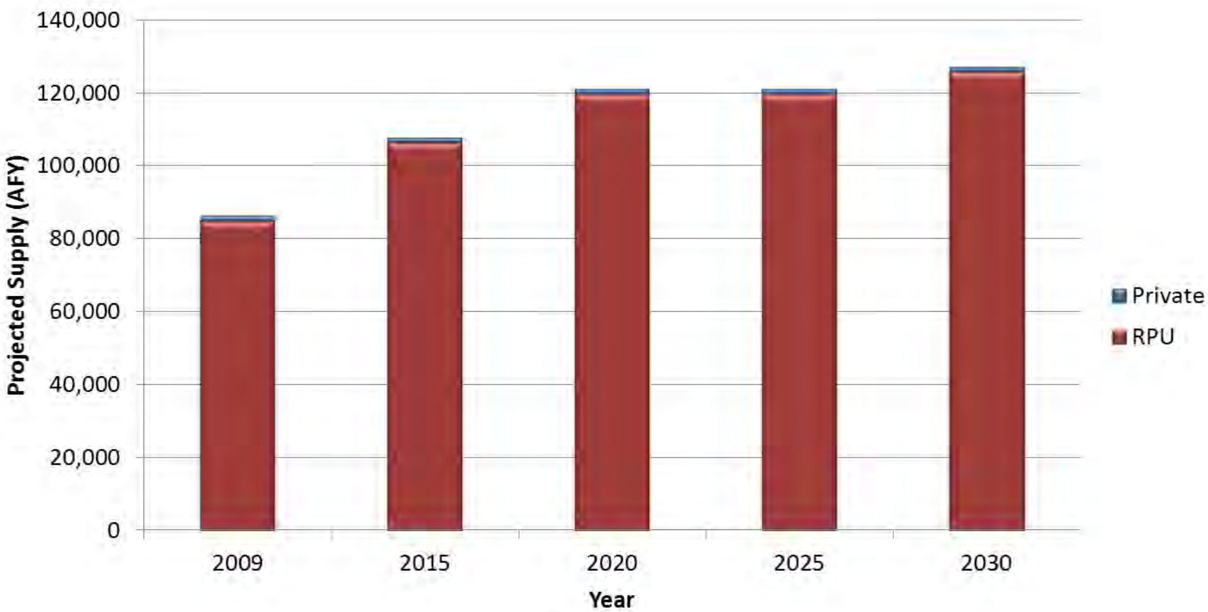


Figure 3.11 Projected Water Supplies for Agencies Wholly or Partially Overlying the Plan Area, by Agency

Table 3.2a Projected Plan Area Groundwater Production (AFY)

Agency	2009	2015	2020	2025	2030
RPU	0	0	0	0	0
Western – Arlington Desalter	6,935	8,250	12,000*	12,000*	12,000*
Private	1,668	1,500	1,500	1,500	1,500
Total Groundwater Pumping	**8,603**	**9,750**	**13,500**	**13,500**	**13,500**

* Projected Western-Arlington Desalter production is the maximum currently anticipated. This value may be lower in the future due to a variety of factors involved in expanding this facility.
Sources: RPU, pers. comm., July 22, 2009; Western, pers. comm., July 1, 2009; Western, 2008b; Valley District and Western, 2010.

Table 3.2b Projected Plan Area Artificial Groundwater Recharge (AFY)

	2009	2015	2020	2025	2030
Groundwater Recharge	0	400*	4,000*	4,000*	4,000*

* Values are based on current understanding of basin conditions and desalter production.
Source: Western, pers. comm., February 8, 2011.

The projected Plan Area groundwater supplies are shown on Figure 3.12 with the historical production discussed in Section 3.1. Figure 3.13 shows projected agency demand by supply type for RPU and private producers. Projected supplies for RPU include supplies for use throughout its full service areas, including areas outside the Plan Area.

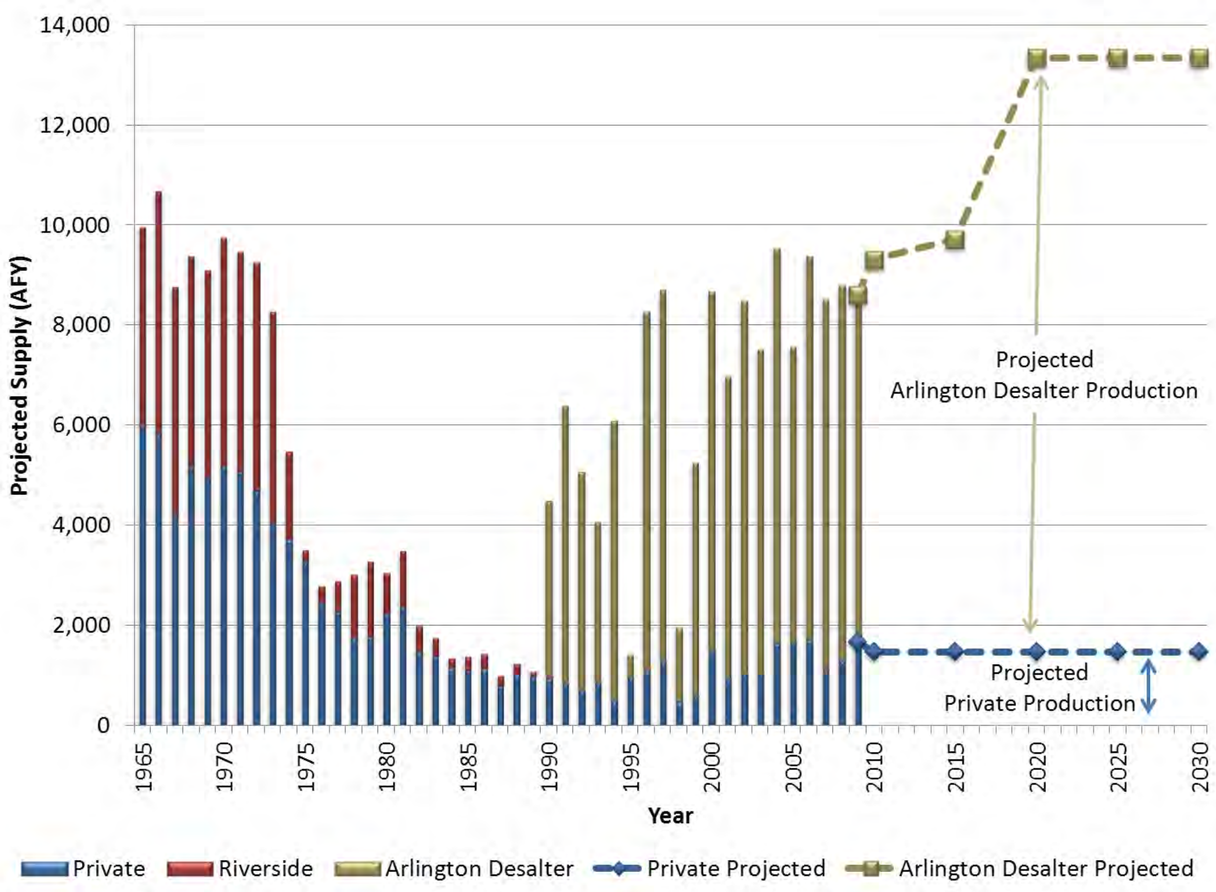


Figure 3.12 Historical and Projected Groundwater Production for the Plan Area

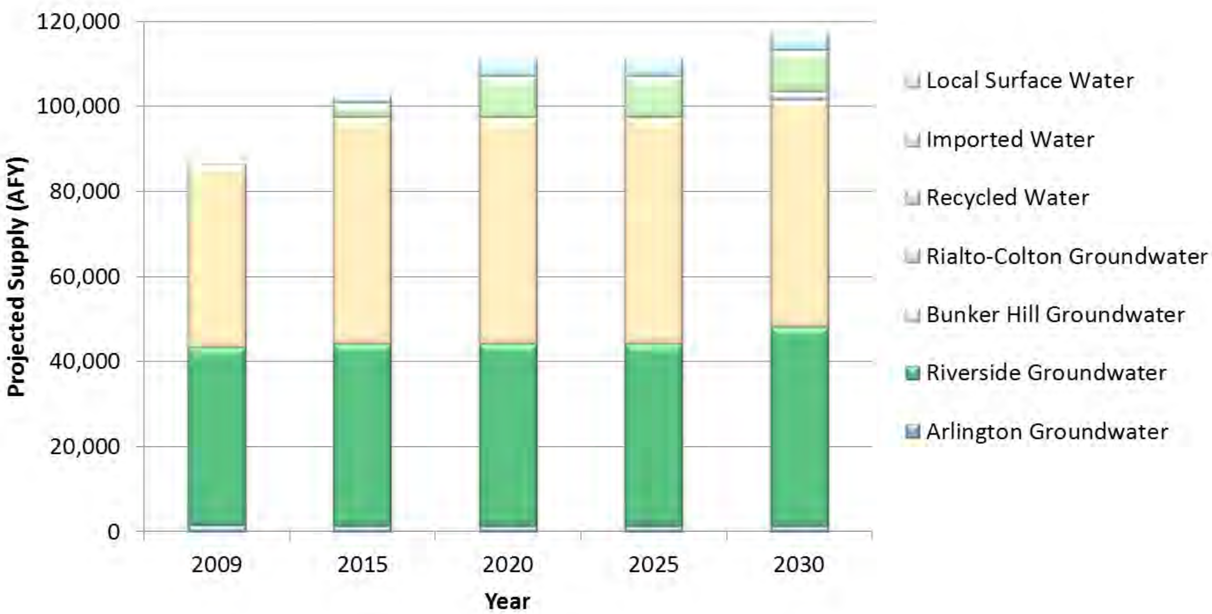


Figure 3.13 Projected Water Supplies for Agencies Wholly or Partially Overlying the Plan Area, by Supply Type

Details of the water supply projections for RPU, the Arlington Desalter, and the private pumpers are provided in the following sections. The projections are for supplies for the entire agency, not solely the portion within the Plan Area. RPU's service area is 27% within the Plan Area.

3.3.1 RIVERSIDE PUBLIC UTILITIES

Water supplies for RPU are projected to increase from 93,500 AF currently to 125,750 AF in 2030 (RPU, pers. comm., October 8, 2009; RPU, 2009), as shown on Figure 3.14 Supplies met by conservation, 10,000 AFY by 2030, are not shown in the chart. Additional new sources of water to meet future needs are the following:

- 10,000 AFY of water conservation, including toilet retrofits, weather-based irrigation controllers, and turf replacement programs. 5,000 AFY of conservation is expected to be in place by 2015.
- Expansion of the recycled water system to provide 9,700 AFY of recycled water, with a first phase providing 3,400 AFY of recycled water by 2015.
- Substitution of 4,000 AFY of non-potable groundwater to the Upper Gage Canal at UC Riverside, freeing up 4,000 AFY of potable groundwater by 2015.

- o Increase in production from Riverside Basin of approximately 14,400 AFY, including operation of recharge basins along the Santa Ana River in Riverside North to increase overall basin yield.
- o Decrease in production from Bunker Hill Basin by approximately 6,200 AFY
- o Full participation in the Seven Oaks Dam conservation project, resulting in an additional 4,000 AFY of groundwater production, on average.
- o Development of a well in the Colton Basin to provide 2,000 AFY of supply (CDM, 2009).
- o No usage of Arlington groundwater is currently projected for RPU.

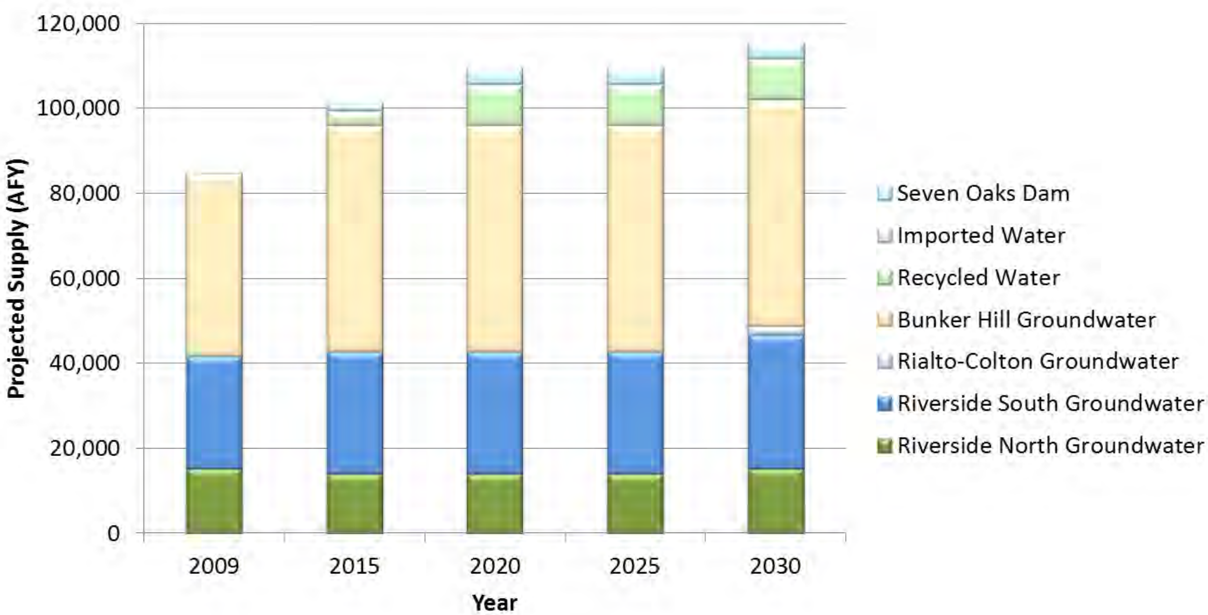


Figure 3.14 Projected Water Supply for RPU

3.3.2 WESTERN – ARLINGTON DESALTER

Western is in the planning phases for an expansion of the Arlington Desalter by increasing the product water from 6.3 mgd to up to 10.0 mgd. This would allow the Arlington Desalter to supply more water for Western's service area. By 2020, the Arlington Desalter is projected to be pumping 11,872 AFY of groundwater from the Plan Area (Western, 2009b).

The project may be combined with artificial recharge of recycled, storm water, and dry weather water through ongoing cooperation with the RCFCWCD. This is projected to result in the recharge of 4,000 AFY of water to the groundwater basin by 2020 (Western, 2009b).

3.3.3 PRIVATE GROUNDWATER PRODUCERS

No projections of private groundwater use are available. Historical trends, shown on Figure 3.6, indicate a demand of 1,501 AFY over the past 5 years. Future use is assumed to continue at this level through 2030.

4.1 LONG-TERM BASIN YIELD DEFINITION

The long-term basin yield of the Arlington Basin was estimated using the calibrated numerical groundwater model of the Riverside and Arlington Basins: RAGFM. The usage of RAGFM in this analysis is documented in *Riverside-Arlington Groundwater Flow Model (RAGFM), Model Development and Scenarios* (WRIME, 2011a). Long-term basin yield was estimated by RAGFM, utilizing:

- **A sufficiently long simulation period to represent or approximate long-time mean climatological conditions**: The modeling analysis includes a 43-year hydrologic period (1965-2007) that includes wet, dry, and normal periods and is considered representative of long-term mean climatological conditions
- **A given pattern of extractions:** The modeling analysis utilizes the current level of extractions as represented by 2007 production data
- **A particular set of physical conditions or structures as such affect the net recharge of the groundwater body:** The modeling analysis utilizes 2007 land use and water use conditions and includes Western's Arlington Desalter
- **A given amount of usable underground storage capacity**: The model identifies usable storage capacity through the physical bedrock representation and the incorporation of the depth and screened intervals of wells

4.2 WATER BUDGET

The yield analysis is based on a water budget that provides information on the components of inflow and outflow in a groundwater basin and the resulting change in storage. While dependent on climatic variability and other factors, such information can show the major sources of inflow and outflow and provide information on the sustainability of water use in a basin. A water budget study of the Plan Area was performed as part of the yield analysis and is included as *Riverside-Arlington Groundwater Flow Model (RAGFM): Model Development and Scenarios* (WRIME, 2011a). The analysis was based on a water budget. The simplified version of the water budget equation for a basin is:

$$\textbf{Inflow} - \textbf{Outflow} = \pm\textbf{Storage Change} \qquad (1)$$

Storage Change may be positive or negative, depending on the magnitude of Inflow and Outflow. Inflow, Outflow, and Storage Change consist of the following more detailed subcomponents :

- Inflow

    - Applied water components
        - Agricultural water use
        - Landscape and outdoor irrigation
        - Leakage from water and sewer systems
    - Recharge from direct precipitation
    - Recharge from water courses
    - Boundary flow
    - Underflow from Temescal Basin
    - Underflow from Riverside South
- Outflow
    - Groundwater production, including desalter production
    - Underflow to Temescal Basin (through the Arlington Gap)
    - Evapotranspiration
    - Discharge to surface drainage
    - Underflow to Riverside South
- Groundwater storage change

Groundwater storage change was developed based on changes in water levels and corresponding changes in saturated volumes in the aquifer over time. A detailed description of the methodology for developing the storage change value and values for other major components of the water budget are included in WRIME (2011a).

The average annual water budget for the modeled Existing Conditions Baseline for the Plan Area is presented in Table 4.1.

Table 4.1
Average Annual Plan Area Water Balance for Modeled Existing Conditions Baseline

Water Budget Component	Average Annual Volume (AFY)
Groundwater production (private producers)	1,150
Desalter production*	5,180
Underflow to Temescal Basin	0
Underflow and surface discharge to Hole Lake area	160
Underflow to Riverside South	570
Total Outflow	***7,060***
Recharge from applied water and precipitation	890
Boundary flow and recharge from other watercourses	4,400
Underflow from Temescal Basin	920
Underflow from Riverside South	470
Total Inflow	***6,690***
Change in Storage	***-370***

Sources and methods are presented in *Riverside-Arlington Groundwater Flow Model (RAGFM): Model Development and Scenarios* (WRIME, 2011a).
*Desalter production reduced by 70% from 2007 conditions as 2007 production resulted in some modeled wells going dry.

The simulated recharge amount is lower than the estimate of Arlington Basin recharge performed in an earlier study (Wildermuth, 2007), which estimated recharge as 8,500 AFY for the year 2004.

4.3 LONG-TERM BASIN YIELD ESTIMATE

The long-term basin yield results of *Riverside-Arlington Groundwater Flow Model (RAGFM): Model Development and Scenarios* and their relation to basin production are shown in Tables 4.2 and 4.3. The long-term basin yield was estimated from the average annual groundwater production plus the average annual change in storage.

Table 4.2
2009 Groundwater Production and Long-Term Basin Yield Estimate (AFY)

2009 Production*	Long-Term Basin Yield	Overdraft
8,600	6,000	2,600

*Production includes desalter wells

Table 4.3
Projected 2030 Groundwater Production and Long-Term Basin Yield Estimate (AFY)

Projected 2030 Production*	Long-Term Basin Yield	Projected 2030 Artificial Recharge	Projected Overdraft
13,500	6,000	4,000	3,500**

*Production includes desalter wells. As noted in Table 3.2a, the projected desalter production is the maximum currently anticipated. This value may be lower in the future due to a variety of factors involved in expanding this facility.

** Projected overdraft is estimated by the amount that Projected 2030 Production minus Projected 2030 Artificial Recharge exceeds the Long-term basin yield. All three of these values are subject to uncertainty.

Tables 4.2 and 4.3 show that current and future production exceed the estimated long-term basin yield. A portion of the projected production increase will be offset by projected new artificial recharge.

The understanding of the relationship between long-term basin yield and 2009 and projected production is a key element in maintaining and developing efficient management policies among stakeholders in the Arlington Basin. Groundwater management objectives, elements, and implementation are based on these values and are discussed in detail in Sections 5, 6, and 7 of this document.

5 GOALS AND OBJECTIVES FOR THE BASIN

5.1 GOAL

The goal of the GWMP is to operate the groundwater basin in a sustainable manner for reliable supply for beneficial uses.

Sustainable is defined as being able to continue groundwater production in the future with a similar real cost, quantity, and end-user quality as today. Beneficial uses include water supplies for municipal use, agricultural use, private wells, environmental purposes, and downstream users.

Four BMOs are defined below to support this goal. In turn, elements are presented in Section 6, Elements of the GWMP, and implementation is presented in Section 7, Implementation, to support the objectives and elements. Together these function as the overall groundwater strategy for the basin.

5.2 BASIN MANAGEMENT OBJECTIVE COMPONENTS

Basin management objectives are adaptable, quantifiable objectives with prescribed monitoring and defined reporting and responses. BMOs are defined through:

- Management areas and sub-areas
- Public input
- Monitoring
- Adaptive management
- Enforcement

5.2.1 MANAGEMENT AREAS AND SUB-AREAS

The management area is the entire Plan Area for most BMOs. Sub-areas are not used in these BMOs, as there are no easily delineable areas with significantly different hydrogeologic conditions. The only BMO that uses sub-areas is the BMO to Maintain or Improve Groundwater Quality, which incorporates the Management Zones defined by the RWQCB's Basin Plan (see Figure 1.7).

5.2.2 PUBLIC INPUT

Public input is important in establishing BMOs. Local knowledge is needed to develop appropriate objectives and local acceptance is necessary to ensure implementation. Public input for the BMOs was gathered through Advisory Committee meetings and public meetings, as described in Sections 1.7 and 0.

5.2.3 MONITORING

Accurate, consistent, and accepted monitoring procedures are necessary to implement the quantitative BMOs. This monitoring will document whether objectives are being met and will trigger actions if defined thresholds are exceeded. The monitoring protocol must allow for quick and easy sharing of data among all stakeholders to gain acceptability and to allow for action, if needed, in a timely fashion. Monitoring is described under each BMO and in Appendix D.

5.2.4 ADAPTIVE MANAGEMENT

Every year brings new data and new conditions to the Arlington Basin. The BMOs are intended to be flexible, allowing for change due to changes in basin operations and in understanding of the groundwater basin characteristics. Adjustments to BMOs are discussed in Section 6.4.5, Reporting and Updating.

5.2.5 ENFORCEMENT

In its current form, the GWMP does not have enforcement mechanisms for the BMOs. The BMOs are guidelines to be monitored and reported for the benefit of all basin users. As the BMOs are defined to meet a common goal, it is intended that enforcement will not be necessary. However, future plan revisions may implement enforcement mechanisms if deemed necessary by the stakeholders in the basin.

5.3 BASIN MANAGEMENT OBJECTIVES

The BMOs include definitions of acceptable groundwater levels, groundwater quality, inelastic land subsidence, and groundwater/ surface water interaction within the Plan Area, along with actions to be taken when defined thresholds are met.

5.3.1 MAINTAIN ACCEPTABLE GROUNDWATER LEVELS

Management of groundwater levels in the Arlington Basin is important to ensure a long-term sustainable supply. Key components of the water level strategy include maintaining adequate groundwater in storage to ensure that the ability of existing infrastructure to produce groundwater is not impacted by declining groundwater levels; and controlling migration of Arlington Basin groundwater, which is typically of lower quality than surrounding basins with respect to regional non-point source contaminants.

Groundwater level monitoring, thresholds, and actions are defined below. Monitoring includes groundwater level measurements within a month of November 15 of each year from three identified wells. The three well measurements are compared to the thresholds defined below:

- Threshold 1: Groundwater elevations are below the historical low groundwater elevation.
- Threshold 2: Groundwater elevations are 10 feet below the historical low groundwater elevation.

If Threshold 1 is violated for all or some of the wells, the Advisory Committee will meet to discuss the situation, including an analysis of trends, potential impacts to groundwater users or the environment, and the most appropriate actions, both immediate and upon Threshold 2 (if met). Actions will be based on the plan elements defined in Section 6, Elements of the Groundwater Management Plan, and the projects defined in Section 7, Implementation of the Groundwater Management Plan. These actions may include:

- Continued operation
- Conservation measures
- Increased monitoring
- Decreased production
- Accelerated development of recharge projects
- Substitution of alternate supplies
- Reoperation of existing wells or construction of new wells to move production to other parts of the basin

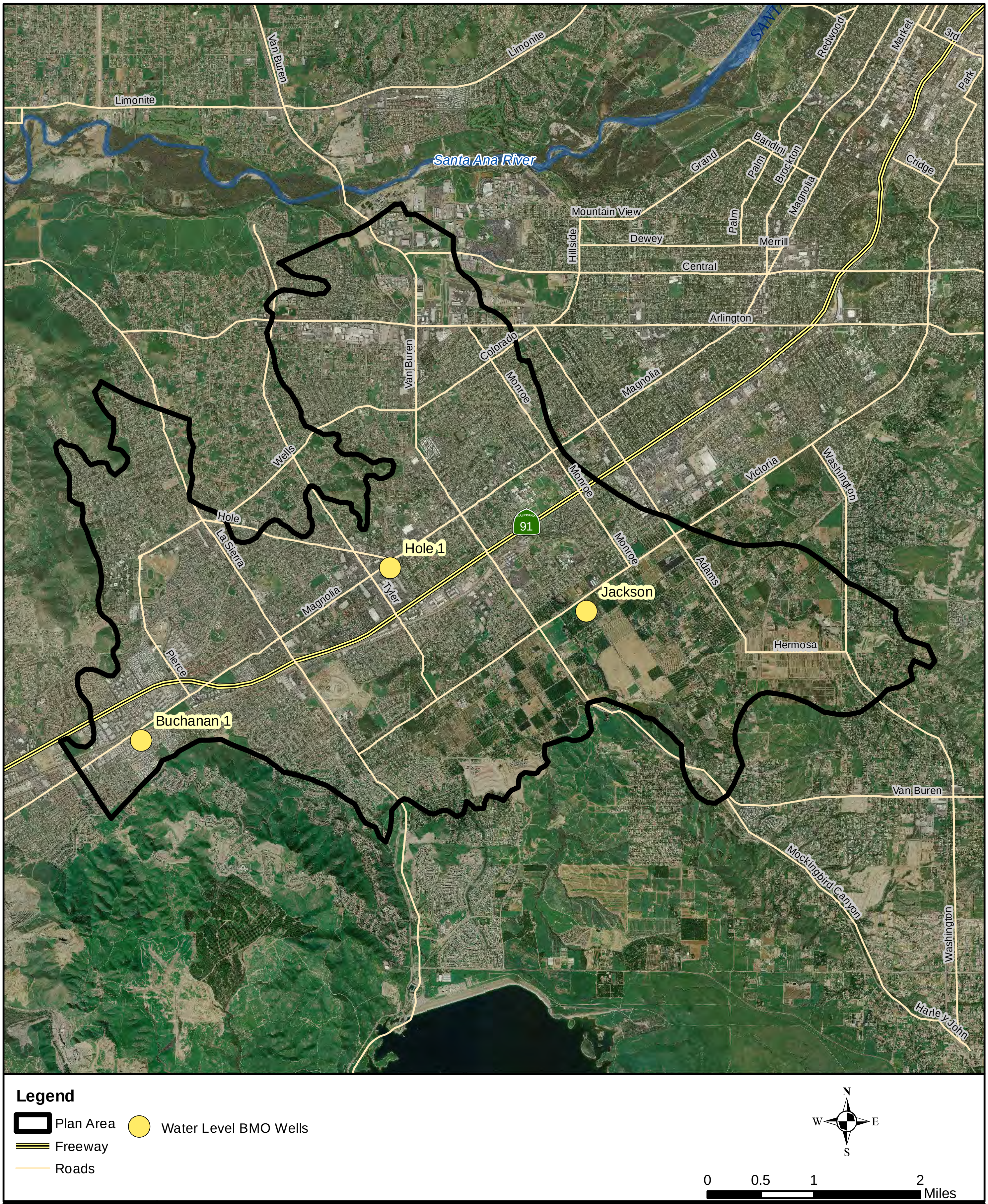
If Threshold 2 is violated, the actions defined for Threshold 1, and any additional measures deemed necessary by the Advisory Committee, will be implemented.

Groundwater level BMO thresholds are shown in Table 5.1 for the wells shown on Figure 5.1 based on the hydrographs included on Figure 5.2. Efforts should be made to get formal access agreements put into place. If the ability to monitor the well over a long-term period is deemed questionable, an alternate well should be used for BMO monitoring.

Table 5.1 Groundwater Level BMO Thresholds

Well	8/2010 Levels (feet msl)	Threshold 1 (feet msl)	Threshold 2 (feet msl)
Buchanan #1 & #2	637.35	635	625
Hole #1	705.49	700	690
Jackson	814.47	805	795

msl = mean sea level



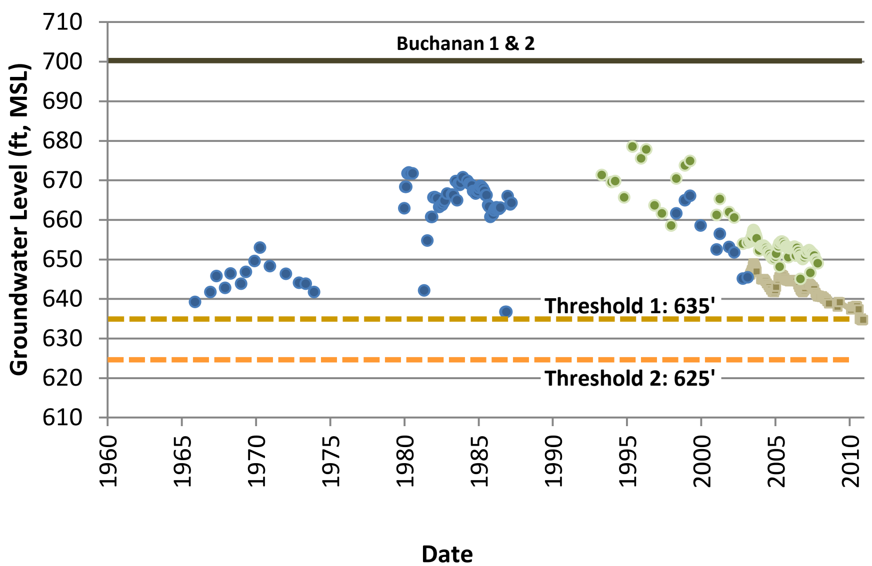
Wells Monitored for Water Level BMOs

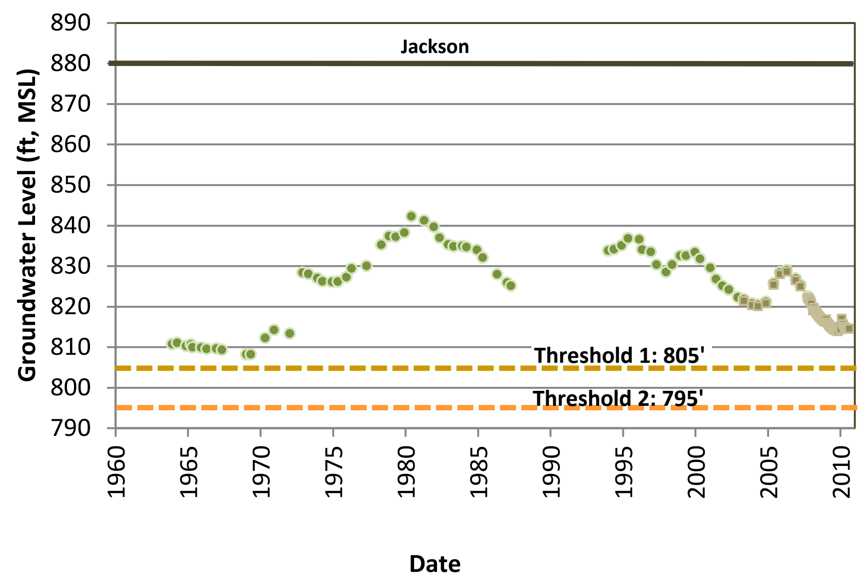
Arlington Basin Groundwater Management Plan

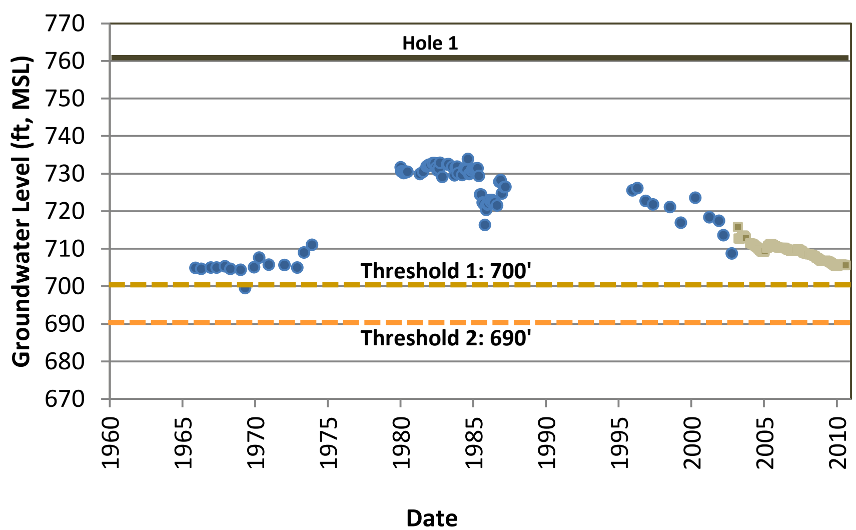
WESTERN MUNICIPAL WATER DISTRICT

2010

Figure 5.1







Ground surface elevation - approximate, based on USGS digital elevation model
Groundwater level from SABRINA database
Groundwater level from AWQ database
Groundwater level from Cooperative Well Measurement Program database

WESTERN MUNICIPAL WATER DISTRICT

Water Level BMO Hydrographs

2010

Arlington Basin Groundwater Management Plan

Figure 5.2

5.3.2 Maintain or Improve Groundwater Quality

The RWQCB has defined water quality objectives through the Basin Plan (see Section 1.6.3) for the Plan Area based on nitrate as N and TDS concentrations. The GWMP will work within this framework to meet the Basin Plan objectives, including recognition of Management Zones as defined in the Basin Plan (see Figure 1.7). Efforts will also be made to ensure that sufficient, high quality data are collected for future analyses of compliance with Basin Plan objectives.

Water quality thresholds are defined as the following:

- Threshold 1: Average nitrate as N or TDS, as computed by the RWQCB, is 90% of the management objective.
- Threshold 2: Average nitrate or TDS, as computed by the RWQCB, exceeds the management objective.

Data developed in regular reports by the Basin Monitoring Program Task Force and the RWQCB (e.g., *Recomputation of Ambient Water Quality in the Santa Ana River Watershed for the Period 1987 to 2006*) will be compared to these thresholds.

If Threshold 1 is violated, the Advisory Committee will meet to discuss the situation, including an analysis of trends, potential impacts to groundwater users or the environment, and the most appropriate actions, both immediate and in the event that Threshold 2 levels are met. Actions will be based on the plan elements defined in Section 6, Elements of the Groundwater Management Plan, and the projects defined in Section 7.1, Potential Opportunities. These actions may include:

- Continued operation
- Increased monitoring
- Studies of sources of contamination and additional options to manage water quality
- Altered desalter operation
- Altered operation of recharge basins
- Reoperation or new wells to move production to other parts of the basin or different depths
- Substitution of alternate supplies

If Threshold 2 is violated, the actions defined for Threshold 1 and any additional measures deemed necessary by the Advisory Committee may be implemented.

Groundwater quality BMO thresholds are shown in Table 5.2.

Table 5.2 Groundwater Quality BMO Thresholds

Sub-area	Nitrate as N Thresholds		TDS Thresholds		Current (2006) Status
	Threshold 1	Threshold 2	Threshold 1	Threshold 2	
Arlington	9.0	10.0	880	980	Nitrate Threshold 2 exceeded TDS Threshold 1 exceeded
Riverside-D	9.0	10.0	730	810	Insufficient data

5.3.3 Implement Land Subsidence Monitoring

The land subsidence BMO focuses on increased understanding of the problem through additional monitoring activities. Additional surveys by spirit-leveling or using Global Positioning Satellites (GPS), Satellite Interferometric Synthetic Aperture Radar (InSAR) analysis, and/ or extensometers could better define the extent of subsidence within the Arlington Basin. Currently, the understanding of the problem is limited, as studies have not been performed due to the absence of reported damage from subsidence. As monitoring becomes sufficiently cost-effective given the current understanding of subsidence risks in the basin, new monitoring may be established and a quantitative BMO may be established under the reporting and updating element contained in Section 6.4.5, Reporting and Updating. A benefit of InSAR analysis is its ability to use historical imagery to estimate subsidence, limiting the need for establishment of baseline conditions.

Actions will be based on the plan elements defined in Section 6, Elements of the Groundwater Management Plan, notably Section 6.3.4, Inelastic Land Subsidence.

5.3.4 Manage the Interaction of Surface Water and Groundwater for the Maintenance of Groundwater and Surface Water Quantity and Quality

This BMO seeks to manage changes in surface water flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping in the basin. As discussed in Section 2.3.8, while groundwater and surface water in the Arlington Basin are linked, there are no major watercourses in the basin.

No quantitative thresholds are set for this BMO, however, a qualitative objective of maintaining or improving the interaction of surface water and groundwater is as follows:

- Water quality in the small watercourses entering the basin will be maintained at a level to support the beneficial uses of groundwater in the basin, as the watercourses are a source of recharge to the basin.

- Groundwater levels and quality will be maintained at a level to support the beneficial uses of the Santa Ana River, as groundwater discharges to the Hole Lake area, eventually feeding the Santa Ana.

6 ELEMENTS OF THE GROUNDWATER MANAGEMENT PLAN

The Elements of the GWMP provide actions that, when implemented, are intended to meet the defined objectives and goals. California Water Code section 10753.8 states that a GWMP may include components relating to all of the following:

- Control of saline water intrusion
- Identification and management of wellhead protection areas and recharge areas
- Regulation of migration of contaminated groundwater
- Administration of a well abandonment and well destruction program
- Mitigation of overdraft conditions
- Replenishment of groundwater extracted by water producers
- Monitoring of groundwater levels and storage
- Facilitation of conjunctive use operations
- Identification of well construction policies
- Construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects
- Development of relationships with state and federal regulatory agencies
- Review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination

Additionally, as described in Section 1.9, there are numerous recommended items to include in GWMPs. These include the following:

- The monitoring and management of groundwater levels, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping
- A plan to involve other agencies that enables the local agency to work cooperatively with other public entities whose service areas or boundaries overlie the groundwater basin
- Public outreach and stakeholder involvement

These elements are grouped into broad categories on Figure 6.1 and in Table 6.1 to show how the elements interact to allow the Arlington Basin to move toward meeting the goal of operating the groundwater basin in a sustainable manner for reliable supply for beneficial uses. Elements and actions defined under the Groundwater Volume, Groundwater Quality, and Surface Water/ Groundwater Interaction categories all pass through a monitoring element which allows for policy decisions based on reporting, coordination, and stakeholder involvement. Table 6.1 relates the individual elements to the categories and to the objectives. The remainder of this section addresses each element, including actions.

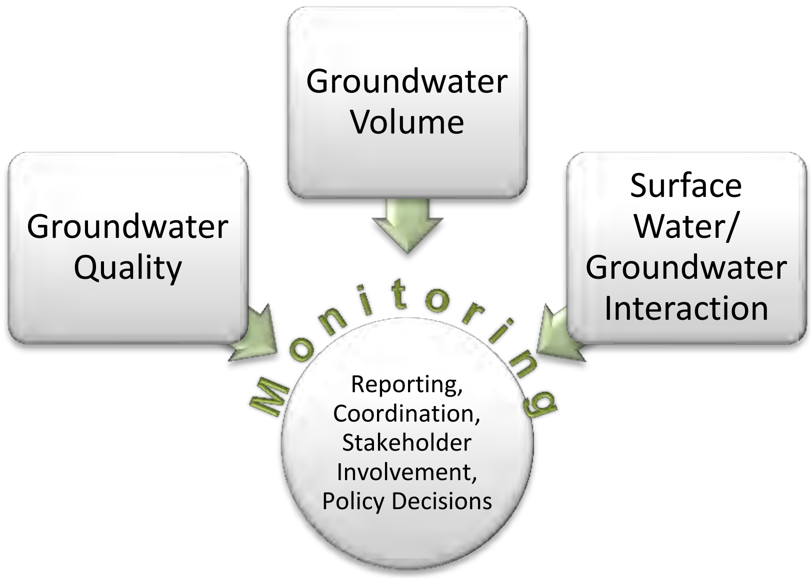


Figure 6.1 Interaction of Elements

Table 6.1
Summary of GWMP Objectives and Elements

Item	BMOs: Maintain Acceptable Groundwater Levels	BMOs: Maintain or Improve Groundwater Quality	BMOs: Implement Land Subsidence Monitoring	BMOs: Manage Interaction of Surface Water And Groundwater
Groundwater Volume				
Mitigation of overdraft conditions	✓	✓		✓
Replenishment of groundwater extracted by water producers	✓	✓		✓
Facilitation of conjunctive use operations	✓	✓		✓
Groundwater Quality				
Control of saline water intrusion		✓		✓
Identification and management of wellhead protection areas and recharge areas	✓	✓		✓
Regulation of migration of contaminated groundwater		✓		✓
Administration of a well abandonment and well destruction program		✓		✓
Identification of well construction policies		✓		✓
Construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects	✓	✓		✓
Monitoring				
Monitoring of groundwater levels and storage	✓			✓
Monitoring of groundwater quality		✓		✓
Monitoring of surface water/ groundwater interaction	✓	✓		✓
Monitoring of inelastic land subsidence			✓	
Reporting, Coordination, Stakeholder Involvement, Policy Decisions				
Stakeholder involvement	✓	✓	✓	✓
Development of relationships with state and federal regulatory agencies	✓	✓	✓	✓
Coordination with IRWMP efforts	✓	✓	✓	✓
Review of land use plans and coordination with land use planning agencies to assess activities that create a reasonable risk of groundwater contamination	✓	✓		✓
Reporting and updating	✓	✓	✓	✓

6.1 GROUNDWATER VOLUME

6.1.1 MITIGATION OF OVERDRAFT CONDITIONS

The long-term basin yield of the Arlington Basin, as described in Section 4, is estimated at 6,000 AFY. 2009 groundwater production in the Arlington Basin is reported at approximately 8,600 AF, therefore the Arlington Basin is in an overdraft condition by approximately 2,600 AFY. By 2030, production is estimated to increase up to 4,700 AFY, partially balanced by a projected 4,000 AFY of artificial recharge by 2030. The overdraft condition is thus projected to be up to 3,300 AFY by 2030.

Overdraft conditions can be addressed through reduced pumping or increased recharge. Such programs are best undertaken on a regional scale, to share costs and benefits in a cooperative, voluntary manner. Groundwater recharge projects (such as those briefly described in Section 7.1) utilizing storm water to replenish the basin will be critical in reducing the effects of overdraft. Imported or recycled water may also be a source for future direct or in-lieu recharge projects. The groundwater recharge projects described in Section 7, Implementation (specifically the Arlington Basin Recharge Facilities), are essential components in meeting projected demands in the Arlington Basin.

Managing the volume pumped from the aquifer can also mitigate overdraft. The historical data and projected estimates of groundwater production can form the basis for cooperative agreements between willing participants on future pumping.

Actions

A1. *Complete modeling activities and meet with stakeholders to discuss the results and determine the ability of the basin to meet projected groundwater demands.*

A2. *With willing participants, develop equitable methods to manage future basin-wide groundwater production, through development of alternate supplies, limits, fees, incentives, or other means.*

A3. *With willing participants, develop equitable methods to fund and construct recharge facilities or projects to enhance recharge.*

A4. *Encourage the use of shallow groundwater, where present, by pumping for irrigation and other non-potable uses, while avoiding negative impacts to surface water resources.*

6.1.2 REPLENISHMENT OF GROUNDWATER EXTRACTED BY WATER PRODUCERS

Groundwater replenishment will take place to increase stored water in the aquifer for normal and drought periods. Replenishment will occur on a voluntary basis as economically feasible project locations and water sources become available. Replenishment must be considered by entities wishing to increase groundwater production within the basin.

Actions

B1. *Implement direct recharge of recycled water, storm water, imported water, and other surface water.*

B2. *Substitute other water supplies such as water from desalters, imported water, and recycled water for groundwater.*

B3. *Implement conservation efforts.*

B4. *Select recharge water to best manage the quality of both the recharge water and the quality of the receiving waters.*

B5. *Consider a replenishment fee on a per acre-foot basis above a baseline production amount, or other method, to fund regional replenishment activities.*

6.1.3 FACILITATION OF CONJUNCTIVE USE OPERATIONS

Conjunctive use operations can assist in optimizing the usage of diverse water supplies, assisting in meeting BMOs over the long term. Conjunctive use in the Arlington Basin may take the form of direct recharge through spreading basins near sources of water and near high permeability soils, such as within the B soils noted on Figure 2.4. Conjunctive use could also take the form of in-lieu recharge, in which other supply sources, such as imported water or recycled water, may replace groundwater during winter or wet years, allowing groundwater pumping during times of reduced imported water supplies.

Actions

C1. *Develop, implement, and maintain programs and projects to recharge aquifers and to implement conjunctive use. Programs may be local or regional in scope and will be designed to not have an adverse impact on groundwater quality.*

6.2 GROUNDWATER QUALITY

6.2.1 CONTROL OF SALINE WATER INTRUSION

The Arlington Basin has higher TDS than the neighboring Temescal or Riverside Basins (Wildermuth, 2008b). Control of saline water intrusion in this situation involves the management of the groundwater basin in a manner to minimize potential impacts to surrounding basins. By reducing groundwater levels within the Arlington Basin, subsurface outflows into basins with higher quality groundwater is reduced. Further, the Arlington Desalter removes salts from the water before delivery and the brines are disposed of outside of the basin. Removal of salts may improve groundwater quality, depending on the quality of water recharged naturally and artificially to the basin. Continued control of saline water involves management of groundwater levels and operation of the desalters.

Actions

D1. *Operate desalters to remove salts from the aquifer and to maintain water levels at a level low enough to minimize migration of lower quality Arlington Basin groundwater into surrounding basins or the migration of higher quality water into the Arlington Basin. Such operation may require expansion of the existing system. Utilize groundwater models to optimize operations.*

6.2.2 IDENTIFICATION AND MANAGEMENT OF WELLHEAD PROTECTION AREAS AND RECHARGE AREAS

The entire Arlington Basin is a recharge source and requires protection to ensure both high quality recharge as well as to maintain or enhance existing recharge quantities. Boundary flow from the surrounding mountains and recharge from small watercourses are the most important recharge sources in the basin, as discussed in Section 4.2. The ability of these waters to enter the basin and percolate to the aquifer should be maintained or enhanced. The highest priority for recharge preservation is areas with soils conducive to recharge with specific attention to the benefit of unlined channels. Figure 2.4 shows areas identified as Hydrologic Soils Group A. This group has the highest tendency to allow water to soak into the ground rather than run off. Soils classified as B have a lower tendency to allow water to soak into the ground, but are still good areas for recharge compared to C and D soils. Areas covered by these A and B soils are relatively important for recharge quantity and are also points of vulnerability for contaminants to enter the groundwater aquifer.

No drinking water source assessments have been produced by the groundwater agencies for wells in the Arlington Basin. Identification of uses threatening groundwater quality in the Arlington Basin is important to protect the future water quality of the basin. Land use decisions should consider potential long-term groundwater quality, while recognizing that water produced from the Arlington Basin is used for non-potable uses or is extensively treated through the desalters.

Actions

E1. *Preserve and protect aquifer recharge areas, especially soil types A and B.*

E2. *Implement public outreach efforts for recharge areas, storm water management, and dumping.*

E3. *Design recharge facilities to minimize pollutant discharge into storm drainage systems, natural drainage, and aquifers.*

E4. *Decrease storm water runoff, where feasible, by reducing paving in development areas, and by using design practices such as permeable parking bays and porous parking lots with bermed storage areas for rainwater detention. Exercise caution to avoid contamination from oil, gasoline, and other surface chemicals.*

E5. *Manage streams with natural approaches, to the maximum extent possible, where groundwater recharge is likely to occur.*

E6. *Consider offering incentives to landowners to limit their ability to develop their property to maintain or enhance its retention as a natural groundwater recharge area. These incentives will encourage the preservation of natural water courses without creating undue hardship on the property owners, and might include density transfers.*

E7. *Participate in SAWPA's emerging constituents workgroup.*

6.2.3 REGULATION OF THE MIGRATION OF CONTAMINATED GROUNDWATER

Regulating contaminated groundwater migration is important for both protecting existing sources of groundwater and for developing new sources of groundwater. Coordination with regulatory agencies, neighboring agencies and municipalities, and potentially responsible parties will give water managers input into the cleanup and containment of contaminated sites and will improve long-term planning efforts based on the predicted impact of those hazards. Additionally, new, improved, and more cost-effective treatment technologies can potentially result in additional potable or non-potable supplies from groundwater that was previously considered unavailable for use, including brine concentration treatment.

Actions

F1. *Coordinate with local regulatory agencies to share information about contaminated sites and about the basin groundwater system and wells.*

F2. *Develop a regional groundwater quality model to improve the ability to analyze the quality impacts of management decisions.*

6.2.4 ADMINISTRATION OF A WELL ABANDONMENT AND WELL DESTRUCTION PROGRAM

Abandoned or poorly constructed wells should be properly destroyed to prevent migration of surface contaminants down well bores to the aquifer or across clay layers within the aquifer. Well destruction in the basin is administered by Riverside County Community Health Agency's Department of Environmental Health (DEH). Well destruction is performed in accordance with procedures set forth in DWR's *California Well Standards*, Bulletin 74-90 (1990).

Actions

G1. *Survey abandoned wells in the basin both physically and from county records. Utilize historical extraction records to identify potential abandoned wells.*

G2. *Coordinate with DEH on destruction standards and procedures, as well as on logging of status of abandoned and destroyed wells.*

6.2.5 IDENTIFICATION OF WELL CONSTRUCTION POLICIES

Well construction in the basin is administered by DEH. The DEH issues permits for the construction and/ or abandonment of all water wells including, but not limited to, driven wells, monitoring wells, cathodic wells, extraction wells, agricultural wells, and community water supply wells. The wells are inspected during different stages of construction to help verify standards are being met. All drinking water wells are evaluated once installation is complete to ensure compliance with California Well Standards set forth in DWR's *California Well Standards*, Bulletin 74-90 (1990) and minimum drinking water standards.

Actions

H1. *Coordinate with DEH staff to ensure that all are aware of local and regional contamination plumes. Increased restrictions on well construction may be necessary near these plumes.*

6.2.6 CONSTRUCTION AND OPERATION BY THE LOCAL AGENCY OF GROUNDWATER CONTAMINATION CLEANUP, RECHARGE, STORAGE, CONSERVATION, WATER RECYCLING, AND EXTRACTION PROJECTS

Properly designed, constructed, and operated projects can cost effectively move the basin towards meeting water quantity, water quality, and subsidence objectives. These projects will include:

- Groundwater contamination cleanup

Actions: ***I1.*** *Cost-effectively clean up or contain point-source (e.g., leaking underground tanks) and non-point-source (e.g., nitrate and TDS) contamination in the groundwater basin. Point-source cleanup activities will include interfacing with regulatory agencies, potentially responsible parties, and other nearby agencies and municipalities. These actions will seek to return the contaminated area, to the extent possible, to a water supply source. Cleanup activities will be performed by the potentially responsible parties, and the regulatory agencies. Payment for impacts to the water system will be sought from the potentially responsible parties. Non-point source contamination cleanup will include the operation of desalter wells, as previously discussed in Section 6.2.1, Control of saline water intrusion.*

- Recharge

Actions: ***I2.*** *Construct and operate* p*rojects to recharge acceptable-quality surplus water to the groundwater basin. Recharge water may include storm water, surface water, recycled water, or imported water. Recharge water will be selected to mutually benefit groundwater quantity and groundwater quality. Recharged water will be captured through existing pumping facilities. It is not anticipated that additional facilities will be needed to extract stored water.*

- Storage – Additional surface storage, while beneficial, is not anticipated in the area beyond small scale water harvesting and detention basins.
- Conservation – Conservation is a key part of water demand management in the basin. RPU and Western are signatories to the MOU of the California Urban Water Conservation Council and participate in demand-side management measures. These agencies have committed to implement best management practices to reduce water demand. Basin agencies also participate in Metropolitan's "Save Water – Save a Buck"

water conservation incentive program. Western has been especially active in developing outreach for water-efficient landscapes.

Actions

I3. *Participate in the programs of the California Urban Water Conservation Council.*

I4. *Encourage installation of water-conserving systems such as dry wells and gray water systems where feasible, especially in new developments. Also encourage installation of cisterns or infiltrators to capture rainwater from roofs for irrigation in the dry season and flood control during heavy storms. Include education programs to protect groundwater quality.*

I5. *Support outreach programs to promote urban and agricultural water conservation and widespread use of water saving technologies.*

- Water recycling – Recycled water is an option from the two nearby tertiary treatment plants: Riverside RWQTP and the Western Riverside County Regional Wastewater Treatment Plant. Regional cooperation is important to minimize costs in the development and extension of recycled water systems. Identification of potential users of recycled water will be based on conveyance costs as well as on the volume, timing, and quality needs of the potential end users.

Actions

I6. *Develop partnerships with treatment plant operators and water purveyors to allow use of recycled water in the nearby area. Efforts will be made to more fully utilize effluent from Riverside's plant for non-potable uses, such as exchanges with the Gage Canal Company or expansion of the existing distribution system as explored in the City of Riverside's Recycled Water Master Plan. Usage of recycled water must balance the need for Santa Ana River in-stream flow related to the Santa Ana River Judgment.*

- Extraction – Additional groundwater extraction wells will likely be necessary to meet future demand.

Actions

I7. *Pair new wells with recharge facilities to reduce impacts, when possible. Groundwater modeling will be performed for larger wells during the planning stages to ensure that there are no significant impacts.*

6.3 MONITORING AND MANAGEMENT

6.3.1 GROUNDWATER LEVELS AND STORAGE

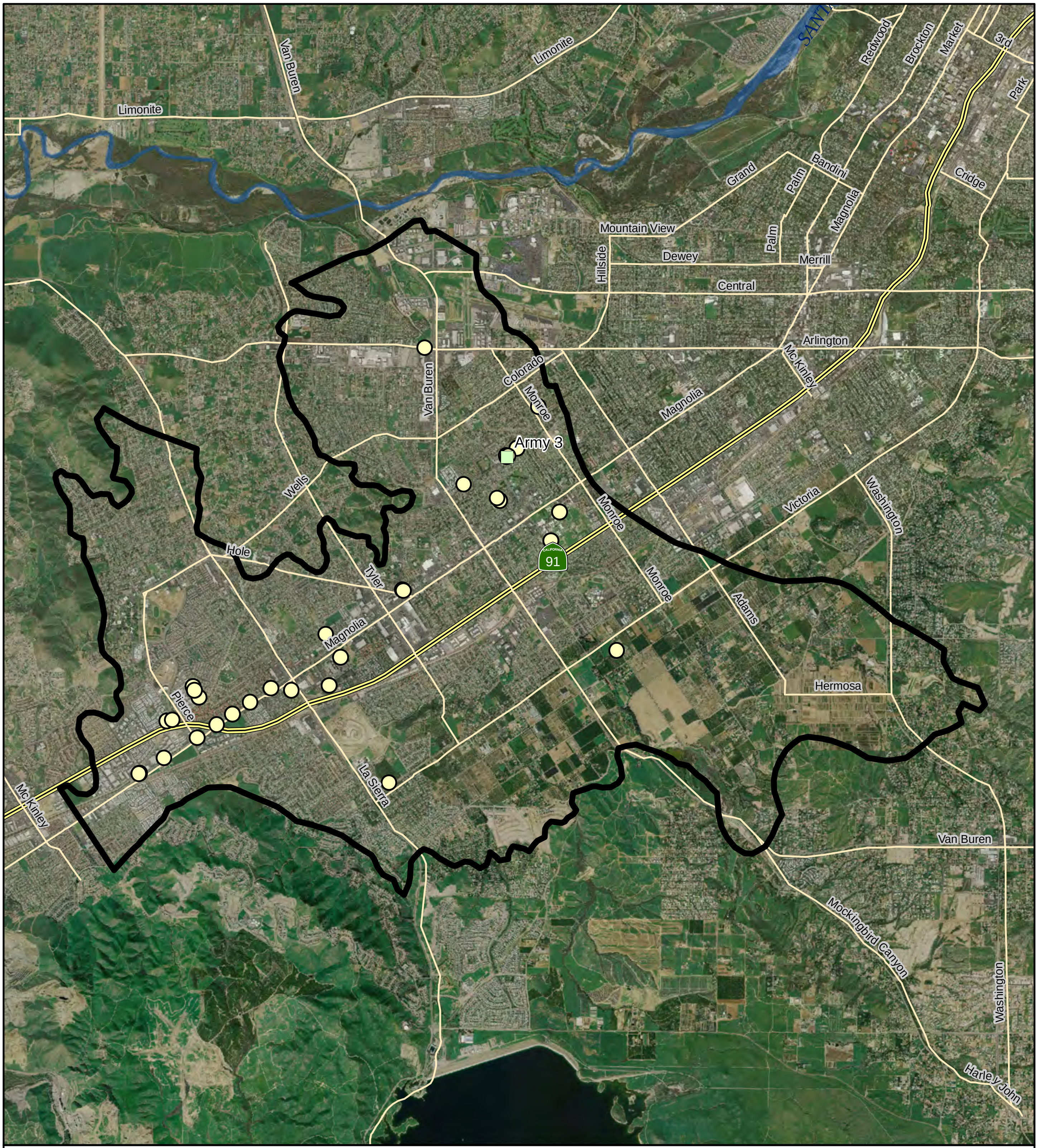
Existing wells monitored for groundwater level in the Arlington Basin are shown on Figure 6.2, which includes all wells in the Arlington Basin with the water level measured at least once in the most recent 5-year period with available data in the Cooperative Well Measuring Program Database (2005 through 2009). The water level measurements can be used to track changes in groundwater storage over time.

To the extent possible, static groundwater level monitoring should continue at all wells that are currently or have recently been measured, as shown on Figure 6.2. Water levels should be measured at least in the spring (within a month of April 15), and in the fall (within a month of November 15). Wells identified for threshold definition in the BMO (see Section 5.3) should be monitored monthly. Data logging pressure transducers should be installed in the BMO wells and in areas without good coverage to determine variability between readings, which may refine future timing of groundwater level measurements. To the extent possible, measurements should be taken when the well and nearby wells are not pumping to represent static water levels. If static conditions cannot be obtained, the pumping status at the well and nearby wells should be noted and preserved in the database, if possible. All water level data will be incorporated into the existing SAWPA databases to support broader regional water management efforts. Additionally, a portion of the water levels will be monitored and reported by Western to DWR as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) program to comply with SBx7 6, which requires groundwater level monitoring and data submittal to DWR in order to remain eligible for state water grants or loans. Additional monitoring protocols are provided in Appendix D.

A key element of monitoring and management of groundwater levels and storage is the RAGFM, developed concurrently with the GWMP (WRIME, 2011a). Related to the monitoring and management of groundwater levels and storage, RAGFM is used to:

- Improve the understanding of the groundwater system
- Aggregate, organize, and analyze existing data
- Identify data gaps
- Simulate impacts on groundwater levels and storage of various programs and projects and of continuation of existing operations

The groundwater model is available from RPU or Western for use by any interested stakeholder. Output from the model is used in the GWMP to ensure that projects are designed to meet the stated goal and objectives.



Legend

- Groundwater Level Monitoring Wells*
- Transducer Wells
- Plan Area
- Highway
- Roads

* Groundwater Level Monitoring Wells are a subset of wells in the Cooperative Well Measuring Program that have groundwater measurment records from 2003 to 2007, locations derived from AWQ Database

N W E S

0 0.5 1 2 Miles

WESTERN MUNICIPAL WATER DISTRICT

Wells Monitored for Groundwater Levels

Arlington Basin Groundwater Management Plan

2010

Figure 6.2

Actions

J1. *Continue the existing static groundwater monitoring program performed through the Cooperative Well Measuring Program with consistent wells and timing of measurements.*

J2. *Ensure compliance with SBx7 6 through participation in DWR's CASGEM program.*

J3. *Coordinate among agencies to ensure that wells continue to be monitored to provide long-term records of static water levels at specific locations, and to ensure a consistent and complete dataset.*

J4. *Install additional data logging pressure transducers where needed to better understand water level fluctuations at finer time scales than captured from manual water level monitoring. Transducers will be located to fill data gaps from areas of interest such as near recharge areas, contaminated sites, or areas of significant pumping. Transducers will also be placed in wells used to monitor for the water level BMO to allow for frequent, automated measurements in addition to the manual measurements.*

J5. *Fill gaps in the water level monitoring network by sampling additional existing or newly constructed monitoring wells.*

J6. *Improve groundwater level monitoring in the Arlington Gap to improve understanding of the direction and volume of subsurface flow in this area.*

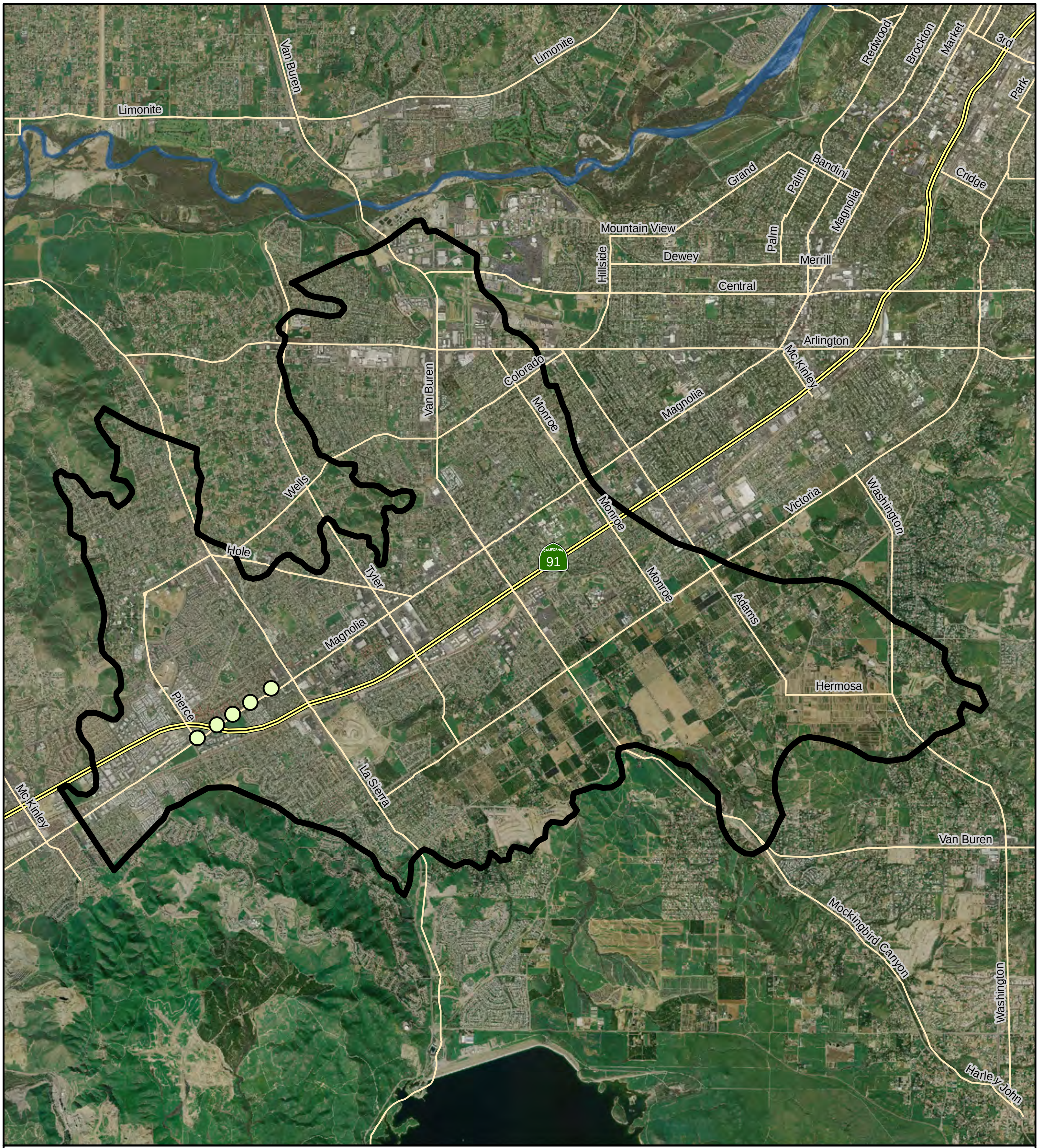
J7. *Improve understanding of bedrock topography through geophysical surveying.*

J8. *Extend groundwater modeling capabilities through the development of a groundwater quality model and an expanded regional groundwater flow model to include surrounding basins.*

6.3.2 Groundwater Quality

Water agencies perform water quality monitoring for Title 22 compliance. Figure 6.3 shows the locations of wells monitored for water quality at least once in the most recent 5-year period with available data in the Ambient Water Quality Database (AWQ), which is now part of the SAWDMS (2003 – 2007). Additional water quality monitoring is needed to ensure sufficient data to define nitrate and TDS concentrations for use by the RWQCB and for the water quality BMOs in this GWMP, as well as to identify the presence or migration of other contaminants of concern. Monitoring protocols are contained in Appendix D. In the most recent update of ambient groundwater quality monitoring (Wildermuth, 2008b), there were insufficient data to compute nitrate and TDS concentrations for the Riverside-D Management Zone (see Figures 2.9a and 2.9b). Coordination with the RWQCB and SAWPA can help define additional monitoring needs for this ambient groundwater monitoring study. Coordination between the agencies is needed to make existing and future monitoring as complete as possible with respects to:

- Spatial distribution
- Depth interval
- Timing
- Analytes



Legend

- Groundwater Quality Monitoring Wells*
- Plan Area
- Highway
- Roads

* Groundwater Quality Monitoring Wells are derived from the AWQ Database and have records from 2003 to 2007

N W E S

0 0.5 1 2 Miles

WESTERN MUNICIPAL WATER DISTRICT

Wells Monitored for Groundwater Quality

Arlington Basin Groundwater Management Plan

2010

Figure 6.3

Actions

K1. *Continue groundwater quality monitoring as required to meet Title 22 requirements.*

K2. *Continue to incorporate all groundwater quality data into the existing SAWPA database to support broader regional water management efforts.*

K3. *Standardize data collection protocols and timing through coordination among agencies.*

K4. *Fill gaps in the water quality monitoring network through sampling additional existing or newly constructed monitoring wells. Filling data gaps will provide better water quality representation for Basin Plan compliance with nitrate and TDS objectives, improved understanding of water quality conditions for well siting, improved monitoring of migration of saline water, and more data for future water quality modeling.*

K5. *Coordinate with the USGS on its National Ambient Water Quality Assessment program and Groundwater Ambient Monitoring and Assessment program to potentially integrate its efforts with local monitoring efforts.*

6.3.3 CHANGES IN SURFACE FLOW AND SURFACE WATER QUALITY THAT DIRECTLY AFFECT GROUNDWATER LEVELS OR QUALITY OR ARE CAUSED BY GROUNDWATER PUMPING

Groundwater/ surface water interaction is complex and requires significant data. While there are no major rivers in the Arlington Basin, surface water resources are important, including Arlington Channel, La Sierra Channel, Arizona Channel, and Hole Lake. As shown previously in Table 4.1, approximately 4,400 AFY of recharge is provided by boundary flow and recharge from other watercourses; this is approximately two thirds of the total basin inflow of 6,690 AFY. This includes both small watercourses within the basin and recharge from the surrounding mountains. Identification, protection, and improvement of this recharge source is important to the continued recharge of the basin.

Limited data are available on the amount of surface water entering or leaving the basin. There are also limited data on the operation of the flood control basins surrounding the Arlington Basin. Improved monitoring of these resources can improve the understanding of recharge conditions and direct future projects to enhance or maintain recharge.

Actions

L1. *Coordinate with the local agencies that collect data necessary to analyze surface flow and surface water quality changes that directly affect groundwater levels or quality or are caused by groundwater pumping. Specifically, coordinate with the Riverside Flood Control and Conservation District to develop monitoring of inflows and outflows from the flood control basins.*

6.3.4 INELASTIC LAND SUBSIDENCE

Monitoring of inelastic land subsidence in the Arlington Basin is limited by the cost of traditional surveys and extensometer compared to the lack of documented historical subsidence in the basin. If land subsidence is reported in the area, or if water levels drop below historical lows, additional land subsidence monitoring will be considered. New technology, InSAR supported by GPS, allows for more cost-effective, regional scale land subsidence monitoring. Over time, these technologies are becoming more robust and less expensive. Lower costs and opportunities to partner with others such as the USGS may allow for land subsidence monitoring in the future.

Actions

M1. *Collect evidence, if any, of active inelastic land subsidence and assess the risk.*

M2. *Develop a land subsidence monitoring program, if needed, using InSAR, GPS, or traditional surveying and extensometer methods.*

M3. *Partner with the USGS or nearby agencies to implement needed monitoring.*

6.4 COORDINATED PLANNING

6.4.1 Stakeholder and Agency Involvement

Ongoing stakeholder involvement, including other private groundwater producers and agencies in the groundwater basin as shown on Figure 1.3, is critical to the successful implementation of the GWMP. Interested parties include agencies within and near the basin, environmental interests, and individuals and groups that rely on the groundwater basin for water supply. Coordination with these groups is necessary to ensure that goals and objectives continue to be consistent with the desires of the community, that a full range of alternatives are considered along with potential adverse impacts, and that progress can be made toward meeting the goals and objectives.

Actions

N1. *Distribute the GWMP in an electronic format to all parties that have expressed interest in the plan, including all agencies within and bordering the basin.*

N2. *Develop a governance plan, including the appropriate MOU or JPA, and an Advisory Committee for implementation.*

N3. *Hold semi-annual meetings of the Advisory Committee to discuss ongoing groundwater management issues and activities. These discussions will include other agencies, thus enabling cooperation between public entities whose service areas or boundaries overlie the groundwater basin. Meetings will focus on potential development of more detailed governance, progress towards meeting BMOs, implementation of projects in this plan, new or updated status on the condition of the groundwater basin, and new or updated plans or strategies.*

N4. *Develop an implementation-focused GWMP web site highlighting implementation activities and soliciting public input.*

N5. *Present actions implemented by the agencies at public meetings of the respective boards.*

N6. *Provide public notice for any revisions to the GWMP.*

6.4.2 DEVELOPMENT OF RELATIONSHIPS WITH STATE AND FEDERAL REGULATORY AGENCIES

Working relationships should be developed with the following federal and state regulatory agencies :

- Federal
  - EPA – contaminated sites
  - USGS – aquifer and watershed conditions, groundwater and surface water monitoring
- State
  - DPH – drinking water quality and vulnerability
  - DTSC – contaminated sites
  - DWR – aquifer conditions, SWP, CASGEM
  - RWQCB – surface water quality and groundwater quality, permitting
  - SWRCB – water rights

Actions

O1. *Coordinate with these federal and state agencies on issues related to monitoring, water rights, and contaminated sites as well as on opportunities for grant funding and loans.*

6.4.3 COORDINATION WITH INTEGRATED REGIONAL WATER MANAGEMENT PLAN EFFORTS

As noted in Section 1, the Plan Area includes the Western IRWMP. Coordination during implementation of the GWMP with the IRWMP effort is important to ensure that local efforts help meet regional goals and vice-versa.

Actions

P1. *Ensure that at least one member of the Advisory Committee is actively involved in the coordination of the IRWMP and the GWMP. These members will provide dialogue between the two efforts.*

6.4.4 REVIEW OF LAND USE PLANS AND COORDINATION WITH LAND USE PLANNING AGENCIES TO ASSESS ACTIVITIES THAT CREATE A REASONABLE RISK OF GROUNDWATER CONTAMINATION

As discussed in Section 6.2.2, certain land uses and activities can potentially impact groundwater quality. Avoiding these uses in recharge areas and near wells is a better strategy than mitigation after the land uses are already in place.

Actions

Q1. *Coordinate between stakeholders and land use planning agencies to encourage the protection of groundwater resources by limiting activities that create an unreasonable risk to groundwater. Maps of well locations, or generalized areas of groundwater production, with soil properties will be provided to assist land use planning agencies in their decision process.*

Q2. *Monitor environmental impact reports and comment on such reports to ensure that the water resources are protected.*

Q3. *Involve water agencies through water supply assessments as required under SB 610. The water supply assessment documents water supply sufficiency by identifying sources of water supply, quantifying water demands, evaluating drought impacts, and providing a comparison of water supply and demand.*

6.4.5 Reporting and Updating

Reporting on the status of the GWMP implementation is important for fulfillment of the actions and projects listed in the plan. Updating the plan is necessary to reflect changing conditions and understanding of the basin.

Actions

R1. *Reports on the GWMP's implementation progress will be produced every 2 years, and will include details on monitoring activities, trigger status of BMOs, project implementation, and new or unresolved issues. Reports and status tables or maps for BMOs will be posted on the Internet, for public access.*

R2. *The GWMP will be updated every 5 years, unless changes in conditions in the basin warrant updates on a different frequency. Updates may be limited to those sections that require updating. The public will be notified of the update and the update will be performed with input from the public and the Advisory Committee.*

7 IMPLEMENTATION

Implementation of the GWMP involves performing the actions described in Section 6, Elements of the Groundwater Management Plan, to meet the BMOs which will lead to meeting the overall goal for the basin. This section describes individual opportunities, programs, and projects that may be implemented in support of the elements. These are only samples of the types of programs that can be implemented based on the elements. Final, implemented programs or projects will differ from those presented below. Potential opportunities are analyzed with the RAGFM to determine their ability as a group to meet the BMOs. A GWMP implementation schedule is provided, along with a description of development of a governance structure, dispute resolution, and financing plan.

7.1 POTENTIAL OPPORTUNITIES

There are numerous opportunities to implement the elements described in Section 6, several of which are described below. The programs or projects are presented for planning purposes to determine if these types of efforts could allow for meeting the overall goal of operating the groundwater basin in a sustainable manner for reliable supply for beneficial uses. Details were developed to a sufficient level to model the projects, but all information is very preliminary in nature as these are not specifically identified projects. Selected opportunities were modeled using RAGFM.

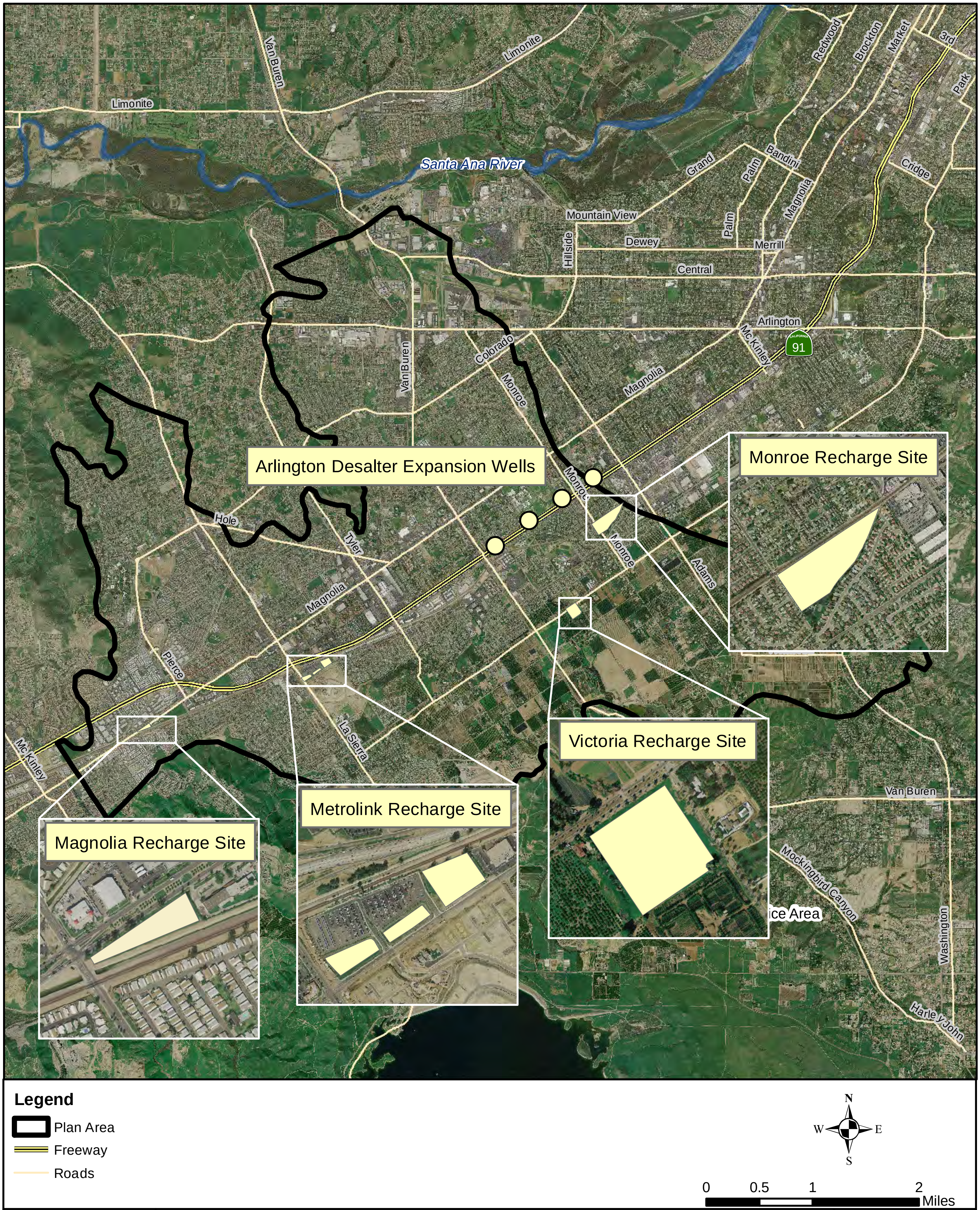
7.1.1 DESCRIPTION OF OPPORTUNITIES

7.1.1.1 Arlington Basin Recharge Facilities

Increasing recharge can increase the long-term basin yield of the basin, allowing for higher sustainable groundwater production. Four potential recharge sites in the Arlington Basin (Magnolia, Metrolink, Victoria, and Monroe) were identified in *Arlington Desalter Expansion Feasibility Study, Task 3 Summary Report* (Wildermuth, 2009) and are summarized below. Of these sites, the Magnolia Recharge Site is no longer being actively considered. The other sites are listed only as potential sites; significant additional work, including field testing and coordination with local land use agencies, would be required to further define these potential projects.

Magnolia Recharge Site

The Magnolia Recharge Site is a 2.6-acre parcel in the western portion of the Arlington Basin between Magnolia Avenue to the north, the Arlington Channel to the south, an industrial parcel to the east, and Buchanan Avenue to the west, as shown on Figure 7.1. This site would be an



WESTERN MUNICIPAL WATER DISTRICT

Locations of Potential Opportunities

Arlington Basin Groundwater Management Plan

2010

Figure 7.1

off-channel basin, and is adjacent to the Arlington Channel and 1,000 feet from the La Sierra Channel.

The site would primarily accept dry-weather flow from the La Sierra Channel, totaling about 51 AF/ month. A second potential water source for this site is storm water from the La Sierra Channel. The maximum recharge capacity for the site is approximately 510 AFY.

Metrolink Recharge Site

The Metrolink Site covers approximately 11 acres near the center of the Arlington Basin, with the Arlington Channel to the north, Indiana Avenue to the south, a bowling alley to the east, and La Sierra Avenue to the west (see Figure 7.1). This site would be an off-channel basin, and could utilize dry-weather and storm flows from the nearby the Arizona and Arlington Channels—totaling approximately 1,050 AFY. The site can also accept approximately 500 AFY of supplemental water (i.e., non-potable groundwater and/ or recycled water).

Victoria Recharge Site

The Victoria Site, shown on Figure 7.1, is approximately 10 acres located downstream from Mockingbird Reservoir in the southeast part of the Arlington Basin, bordered by Victoria Avenue to the north, an agricultural parcel to the south, Jackson Street to the east, and an agricultural parcel to the west. This site would be a flow-through basin; storm water will not need to be diverted and conveyed to the basin. Water may be available from storm water, including releases from Mockingbird Reservoir, as well as non-potable groundwater and/ or recycled water from Western's non-potable system. Imported water may also be used from the Gage Canal Company's pipeline.

Monroe Recharge Site

The Monroe Site is a 5-acre parcel located in the eastern part of the Arlington Basin, as shown on Figure 7.1, within a RCFCWCD detention basin. This site is both a detention basin for flood control and a park/ sports complex for the City of Riverside. The site is situated between railroad tracks to the north, a residential neighborhood to the south and east, and Monroe Street to the west. This site will be a flow-through basin: Storm waters will not need to be diverted and conveyed to the basin.

The site can accept approximately dry-weather flow and storm water from two large storm drains that terminate at the site. Supplemental water from Western's non-potable system could also serve as a relatively small additional source for this site.

7.1.1.2 Arlington Desalter Expansion

The desalter expansion involves the construction of up to four new wells (up to three active wells and up to one standby well) in the eastern portion of the basin near the boundary with the

Riverside Basin. Given the current state of overdraft in the basin, the expansion would likely only occur in concert with recharge projects. The new desalter wells are assumed to begin pumping in 2017 and supply the desalter facility with approximately 6,000 AFY — approximately 4,000 AFY necessary for the facility expansion to up to 10 mgd of product water; and a shift of about 2,000 AFY that is currently produced from the existing desalter wells. Figure 7.1 shows the locations of the existing and potential new desalter wells. A raw water pipeline of approximately 4.5 miles in length would need to be installed to convey the groundwater from the new wells to the desalter facility (Wildermuth, 2008a).

7.1.1.3 Regional Groundwater Modeling

The RAGFM is an important tool for groundwater management in the Riverside and Arlington Basins. However, these basins are connected with other basins in the region. During development of the RAGFM, boundary conditions were coordinated with the groundwater models in the surrounding basins to ease the development of a future regional groundwater model at a larger scale. Such a groundwater model would assist in improving the representation of flow between the basins and would assist in understanding regional flow conditions and their impacts on contaminant plumes, salts, and other regional issues.

7.1.1.4 Groundwater Quality Modeling

The addition of a groundwater quality component to the existing RAGFM or the development of a new groundwater quality model would assist in the management of non-point source and point source contaminants. This includes improved salt management and an improved ability to quantify impacts of water supply projects on regional contaminant plumes and on regional ambient groundwater quality.

7.1.2 Simulated Benefits and Impacts

The RAGFM (See Section 1.3) was used to simulate the potential benefits and impacts of different combinations of potential opportunities within both the Arlington Basin and the Riverside Basin. The simulations compared simulated baseline conditions to conditions with the potential impacts to estimate the benefits and impacts. The following describes modeling results for the baseline and three hypothetical modeling scenarios. Table 7.1 summarizes the simulations and the results.

Table 7.1
Model Simulated Basin Conditions

		Simulation											
		Existing Conditions Baseline			Scenario 2			Scenario 3			Scenario 4		
		Riverside North	Riverside South	Arlington	Riverside North	Riverside South	Arlington	Riverside North	Riverside South	Arlington	Riverside North	Riverside South	Arlington
Groundwater Production (AFY)													
	Flume Wells 2-6	8,210			10,000			10,000			8,210		
	Flume Well 7				4,360			4,360			4,360		
	Colton Wells 30 and 31				8,070			8,070			4,035		
	West Valley New Wells							8,630			3,090		
	WMWD Desalter Wells 1-5			5,200			7,800			7,420			5,025
	WMWD New Desalter Wells									1,935			3,610
	RIX Extraction**	35,800			35,800			35,800			35,800		
	Pellissier ASR Extraction Wells											10,000	
	Other Wells**	20,090	36,330	1,130	20,090	36,330	1,200	20,090	36,480	1,385	20,075	36,310	335
	Subtotal	**64,100**	**36,330**	**6,330**	**78,320**	**36,330**	**9,000**	**86,950**	**36,480**	**10,740**	**75,570**	**46,310**	**8,970**
Groundwater Recharge at Recharge Facilities (AFY)													
	ASR On-Channel Facility (in Rialto-Colton Basin)***				10,000			21,920					
	ASR Off-Channel Facility				3,000			8,980			6,000		
	Pellissier ASR Facility										10,000		
	RIX Percolation Basin Feed**	28,100			28,100			28,100			28,100		
	Arlington Basin Recharge Facilities						3,000			3,980			2,970
	Subtotal	**28,100**	**0**	**0**	**31,100**	**0**	**3,000**	**37,080**	**0**	**3,980**	**44,100**	**0**	**2,970**
Long-Term Average Storage Change (AFY)*		**-1,100**	**-1,280**	**-380**	**-1,230**	**-1,260**	**-260**	**-230**	**-700**	**-420**	**-1,590**	**-1,750**	**-40**
Long-Term Average Groundwater Head (ft)*													
1969 Western Judgment Index Wells	Johnson 1 (in Rialto-Colton Basin)	861.2			866.0			889.7			854.6		
	Flume 2	850.9			849.7			880.2			843.3		
	Flume 5	847.5			845.5			873.2			840.4		
	Average of 3 index wells	853.2			853.7			881.0			846.1		
Riverside North Basin	RA24 (CPC East Side)	850.2			848.5			871.8			842.5		
	RA21 (Twin Butte #6)	829.4			826.8			840.8			819.8		
	RA17 (#8)	833.1			826.7			854.7			820.7		
Riverside South Basin	RE9 (Mulberry)		755.5			753.1			763.7			745.5	
	RC1 (#14, 46th Street)		743.6			743.5			743.8			743.1	
	RD3 (Laura Lane)		739.7			743.6			741.6			735.5	
Arlington Basin	A3 (Buchanan #1)			623.5			638.9			607.9			638.9
	A21 (Water Tower)			737.7			728.3			736.3			728.3

Notes:
* Long-term average is over the 43 years of simulation representing the long-term hydrologic conditions of 1965 to 2007.
** Based on 2007 groundwater recharge and production data.
*** ASR On-Channel Facility recharge is not included in the calculations for Riverside North as this facility is located in Rialto-Colton. Impact of the ASR On-Channel Facility is observed in changes in boundary inflow from Rialto-Colton to Riverside North.

7.1.2.1 Scenario 1: Existing Conditions Baseline

The objective of the Existing Conditions (EC) baseline simulation is to define the land use and water demand and hydrologic conditions that will be used as the basis for comparison of near-term model simulations. The EC baseline represents the basin under the current (2007) land and water use conditions. It is also used to estimate the long-term basin yield under current land use and water demand conditions over the long-term hydrologic conditions. The assumptions, data, and results for the EC Baseline are presented in *Riverside-Arlington Groundwater Flow Model (RAGFM): Model Development and Scenarios* (WRIME, 2011a).

7.1.2.2 Scenario 2: Near-Term Future Projects Conditions

The objective of the near-term future projects conditions (Scenario 2) is to evaluate the sustainability of selected future groundwater recharge and production projects and the effectiveness of these projects in offsetting projected overdraft. The impacts of these projects on groundwater resources were evaluated by comparing the results of Scenario 2 with the EC Baseline results. Scenario 2 represents the EC Baseline land use and water demand conditions with the addition of the following selected projects:

- Proposed Arlington Basin recharge facilities
  - Metrolink Basin
  - Monroe Basin
  - Victoria Basin
- Operation of Existing Arlington Desalter Wells at 7,840 AFY

Additionally, the following projects are included in the Riverside Basin:

- Proposed Riverside North Aquifer Storage and Recovery Facilities, consisting of:
  - Inflatable Dam and On-Channel Recharge Facilities
  - Off-Channel Recharge Facilities
- Proposed Flume 7 Well in Riverside North

Groundwater level impacts of Scenario 2 include mounding at the Victoria recharge site (see Figure 7.1) and lower groundwater levels (compared to EC baseline) in the vicinity of the existing desalter wells and in the area west of La Sierra Avenue due to higher desalter production rates of Scenario 2.

Scenario 2 simulates an average change in storage of -260 AFY for the Arlington Basin (see Table 7.1). This value is 110 AFY higher than the EC Baseline. Details of the scenario and the results are included in *Riverside-Arlington Groundwater Flow Model (RAGFM): Model Development and Scenarios* (WRIME, 2011a).

7.1.2.3 Scenario 3: Long-Term Future Projects Conditions

The objective of Scenario 3 is to estimate the maximum volume of water that can be recharged at the ASR Facilities within certain constraints and evaluate the sustainability of selected future groundwater production projects. The impacts of these projects on groundwater resources were evaluated by comparing the results of Scenario 3 and the EC Baseline. Scenario 3 represents the EC Baseline land use and water demand conditions with the addition of the Scenario 3 projects:

- Proposed Arlington Basin Recharge Facilities
  - Metrolink Basins
  - Monroe Basin
  - Victoria Basin
- Operation of Existing Arlington Desalter Wells
- Proposed New Arlington Desalter Wells

Additionally, the following projects are included in the Riverside Basin:

- Proposed Riverside North Aquifer Storage and Recovery Facilities consisting of:
  - Inflatable Dam and On-Channel Recharge Facilities
  - Off-Channel Recharge Facilities
- Proposed Flume 7 Well
- Colton Wells 30 and 31
- Proposed West Valley Water District (WVWD) wells at 11,190 AFY

Scenario 3 simulates an average change in storage of -430 AFY for the Arlington Basin (see Table 7.1). This value is 70 AFY lower than the EC Baseline. Details of the scenario and the results are included in *Riverside-Arlington Groundwater Flow Model (RAGFM): Model Development and Scenarios* (WRIME, 2011a).

7.1.2.4 Scenario 4: 2015 Future Projects Conditions

The objective of Scenario 4 is to evaluate the sustainability of 2015 future groundwater recharge and production projects and the effectiveness of these projects to offset projected overdraft. The intent of Scenario 4 for Riverside North Basin is to evaluate the impact of new production wells with the ASR Facilities operating at lower recharge rates. Additionally, the impact of the Pellissier Ranch ASR Facilities was evaluated. The impacts of these projects on groundwater resources were evaluated by comparing the results of Scenario 4 and the EC Baseline. Scenario 4 represents the EC Baseline land use and water demand conditions with the addition of the Scenario 4 projects:

- o Proposed Arlington Basin Recharge Facilities
  - Monroe Basin
  - Victoria Basin
- o Existing Arlington Desalter Wells
- o Proposed New Arlington Desalter Wells
- o Reduced Groundwater Production by La Sierra University Wells

Additionally, the following projects are included in the Riverside Basin:

- o Proposed Riverside North Aquifer Storage and Recovery Facilities consisting of Off-Channel Recharge Facilities
- o Pellissier Ranch ASR Facilities
- o Proposed Flume 7 Well
- o Colton Well 30
- o Proposed West Valley Water District (WVWD) wells operating at 5,650 AFY

Scenario 4 simulates an average change in storage of 40 AFY for the Arlington Basin (see Table 7.1). This value is 410 AFY higher than the EC Baseline and is greater than zero, indicating no overdraft on an annual average. Details of the scenario and the results are included in *Riverside-Arlington Groundwater Flow Model (RAGFM): Model Development and Scenarios* (WRIME, 2011a).

7.2 GOVERNANCE

The governance of the Arlington Basin will be determined through discussions amongst the stakeholders. Currently, the basin’s governance is based on the individual-interest model. Under the individual-interest model, stakeholders govern and develop water resource projects individually. However, it is envisioned that under this plan the development of projects will be done following the common goal, objectives, and elements described herein. Additionally, coordination between stakeholders will allow for easier implementation of projects that span all or a portion of the basin.

Initial stakeholder meetings will focus on development of a governance structure, likely through a Memorandum of Understanding (MOU) (individual-interest model) or through a Joint Powers Agreement (JPA) (mutual-interest model). Meetings will be hosted in which representatives from each stakeholder group can get together to discuss and seek to resolve regional groundwater issues. At these meetings, agreements can be made if multiple groups would like to contribute to the development of regional projects outlined in the GWMP; however, the ultimate project-making authority remains within the entity sponsoring the project, unless a JPA is formed through the governance process. Financing is also the responsibility of the sponsoring agency or group, again, unless a JPA is formed through the governance process. The individual groups can enter into agreements to guide subsequent actions and provide funding. Voting at the meetings will be limited to those that have adopted or agreed to the GWMP, although other stakeholders will be encouraged to attend and participate in discussions in a non-voting role.

Advantages to the individual-interest-based approach are:

- Agencies can focus their resources on projects specific to their needs
- There is no loss of management control of individual groundwater resources
- It is easiest to implement because it is a continuation of the current approach to groundwater management in the region

A MOU is needed to formalize such an individual-interest-based model. The MOU would be signed by the water agencies following adoption of the GWMP.

The need for more cohesive management may lead to a mutual-interest model based on a MOU or JPA. The mutual-interest model would:

- Ease pursuing regional projects that would benefit the entire Arlington Basin
- Define who coordinates projects and what role each agency plays during regional project planning, construction, operation, and maintenance
- Generate economies of scale for large projects
- Increase the likelihood of state funding for projects benefiting multiple entities
- Prevent individual stakeholders from undertaking actions that are not complementary to the BMOs
- Expand the framework to resolve conflicts among individuals

A series of meetings will be held with stakeholders to define the appropriate governance structure, prepare and execute the MOU or JPA, and begin governance activities.

7.3 DISPUTE RESOLUTION

Disputes relating to the implementation of the GWMP will be resolved by the Advisory Committee. In the event that the Advisory Committee cannot resolve the dispute, an outside neutral third party will be used to assist the parties in working towards a satisfactory resolution, with completion of all procedures within 60 to 90 days, unless the parties to the dispute agree to a longer timeframe. Costs incurred, if any, in this process will be equally shared by the involved parties.

7.4 FINANCING

As discussed above, financing for individual projects will depend on the governance structure selected by the stakeholders. Under the individual-interest model, financing for projects would come from the proponent, and other beneficiaries if agreements are made. Under the mutual-interest model, financing for projects, reporting, and plan updates could come from the JPA, which in turn is funded by the members. It is anticipated that Western will, at their discretion, provide for updating the GWMP and for the development of annual reports for the entire Arlington Basin, with support from the plan participants for data and review.

7.5 SCHEDULE

Key implementation items are listed in the following schedule:

Item	*Initial Completion*	*Recurrence*
Meet with stakeholders to define and adopt a governance structure	*1 year*	*n/a*
Expand desalter capacity to manage water quality and create supply	*6 years*	*As needed*
Develop recharge facilities to increase yield	*6 years*	*As needed*
Develop groundwater quality model	*4 years*	*As needed*
Fill data gaps in water quality network	*5 years*	*As needed*
Complete subsidence analysis using InSAR	*3 years*	*As needed*
Continue public outreach and education	*2 years*	*Ongoing*
Report on GWMP	*3 years*	*2 years*
Update GWMP	*5 year*	*5 years*

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